FISHERIES BULLETIN No. 14 (1996)

The European eel fishery in 1993 and 1994

edited by

CHRISTOPHER MORIARTY

First report of a working group funded by the European Union Concerted Action AIR A94-1939

Dublin

THE MARINE INSTITUTE, 80 HARCOURT STREET, DUBLIN 2

Fisheries Bulletin
(Dublin) ISSN 0332-4338

THE EUROPEAN EEL FISHERY IN 1993 AND 1994

edited by
CHRISTOPHER MORIARTY
The Marine Institute, Fisheries Research Centre, Abbotstown, Dublin 15, Ireland

ABSTRACT

A group of 17 experts, representing 9 member states of the EU, undertook in March 1995 the Concerted Action AIR A94-1939 entitled *Enhancement of the European eel fishery and conservation of the species*. This paper presents the results of the first phase of the study which aimed to compile a database of information on the eel in the 9 states.

The total annual yield of European eel was estimated to lie between 20,000 t and 30,000 t. Glass eels account for 4% of the total by weight and 33% by value. The value of the catch as paid to the fisherman was estimated at 180 M ECU and with value added as 375 M ECU.

Manpower engaged fulltime in eel fishing was relatively low, fewer than 500 individuals. Numbers engaged part-time totalled at least 25,000. Although rarely providing the mainstay of a fishing community, the eel made a sociological contribution out of all proportion to its cash value.

Yields greater than 5 kg per hectare were attained in a variety of habitats throughout the region. The highest yields per hectare recorded were 324 kg in one Italian coastal lagoon, 75 kg in another, 52 kg in a French Mediterranean lagoon and 40 kg in a Norwegian river and lake system. The yield from most fisheries was less than 5 kg per ha. This implied that proper management could greatly increase yields throughout the geographical range of the species. Between 2 and 3 billion young eels were captured annually, of which more than 95% were killed for consumption at that young stage, while less than 5% were harvested at later stages or left to contribute to the breeding stock. The implication was that adequate glass eels existed for a greatly enhanced stocking programme.

Many eel fisheries had declined in the course of the previous twenty years, the principal factors appearing to be recruitment failure and inadequate management measures. Eel fishing can be undertaken with a low capital investment and provides important opportunities for work in communities where unemployment is high.

INTRODUCTION

The unique status of the eel, a valuable commercial fish with a single known breeding place far outside the territories in which it is exploited, requires management on an international level. A large portion of the geographical range of the growing eel lies within the boundaries of the European Union. Funding for a Concerted Action aimed at formulating a Europe-wide management plan was granted by the EC under its AIR scheme. The project, entitled *Enhancement of the European eel fishery and conservation of the species* is registered as AIR Concerted Action A94-1939. The first 'milestone' in the work plan for the project was the publication of a database of information on the eel.

The author, as project co-ordinator, made two tours to visit the participants in their laboratories in April and July 1995 and one in May 1996. In the course of these visits, two questionnaires (Appendix 1) were devised and circulated to the participants who undertook to complete them for as many regions as possible within their countries. In addition, participants prepared synopses of the eel fishing industry in their countries.

Fourteen of the experts listed in Appendix 2 took part in a working party held in the Fisheries Research Centre in Dublin from 11 to 15 November 1995. At this workshop, summaries of the returned questionnaires were studied together with the country synopses and other material including the data in the FAO Yearbook. This paper presents the data collected and represents the first comprehensive account of the status of the European eel and its fishery.

COUNTRY SYNOPSES

Participants at the Dublin meeting prepared synopses of their knowledge of the state of eel stocks and the eel fishery in their countries. These were arranged under an agreed set of sub-headings and provide background data and opinions to complement the details set out in the tables. After the meeting, extensive data on the eel fisheries of Italy were supplied by Eleonora Ciccotti. These have been summarised in this section. In addition, information received from Norway and Poland is included in the tables.

Sweden - Håkan Wickström and Stellan Hamrin

Glass eel / elver:
The only allowed fishery for glass eels and elvers in Sweden is for restocking/transfer purposes within single river systems, i.e. to lift small eels over the most downstream dam and to distribute them among the lakes of the river system. Glass eels are imported from England and grown to about 1 g for stocking, mainly in inland waters. Numbers stocked were 572,000 in 1993, 1,818,670 in 1994 and 1,660,320 in 1995.

Bootlace eels
There is no fishery for small eels besides the transfer within river systems mentioned above.

Yellow eels
There are three kinds of fisheries for yellow eels:

1. Capture of about 75 t of yellow eels along the Swedish west coast for stocking purposes. These eels are just above the minimum legal size of 370 mm. This activity is decreasing as such eels are not allowed to be stocked as freely as some years ago, falling from 75 t in 1993 to 63 t in 1995.

2. In the same coastal area yellow eels of moderate size are fished for consumption. They are all exported to Denmark and Germany. Total catch from this coast is about 373 t, including the 75 t of small eel.

3. Large yellow eels are caught among silver eels in lakes and in brackish water along the east coast. If in good condition and their proportion is not too high they are sold at the same price as for the silver eels. Almost all eels are exported to Denmark and Germany. The first two categories (1 and 2 above) are caught mainly in small fyke nets and baited pots and the third category (3) by pound nets.

Silver eels
Silver eels are traditionally fished along the Baltic coast (i.e. along the Swedish east and south coasts). Total catch is about 650 tons. The catches have decreased but in recent years the importance of a lake fishery has increased (about 130 tons) as stocking has increased. Silver eels are mainly caught in poundnets but there are also some weirs, traps etc. Almost all silver eels are exported to Denmark and Germany.

Intensive culture
192 tons were reported from culture in 1993.

Consumption
According to official statistics about 96% of the official eel production (including culture) is exported, mainly as live eels to Denmark (738 tons), Germany (205 tons) and The Netherlands. The 'Swedish' and the local market (mainly smoked eels) are covered by the remaining 4% and an unknown volume of unreported catches. Some eels are imported from Canada, New Zealand etc. for consumption.

Public perception of eel fishing:
Fishing for migrating eels is traditionally very important along the Baltic Coast. In lakes eel is today the prerequisite for a rational fishery with such large gears as poundnets. Such gears also catch other valuable species including pike-perch, perch and pike. Together eels and other catch give a good income to the lake fishermen. The fishery for yellow eels along the west coast is today better controlled than before due to new legislation restricting the number of fykes for the non licensed fishermen. Most probably there are considerable amounts caught and not reported. Pure sport fishing (with rod and line) for eels is probably insignificant.

Contamination
Fish with high fat content like the eel always have elevated levels of chlorinated hydrocarbons. The content will increase with age and is inversely related to growth rate. Oligotrophic water areas affected by old, local discharge of chlorinated hydrocarbons might contain eels with levels of these substances not suitable for consumption. Today these substances are not allowed unless used in totally closed systems.

Parasites / Diseases
The parasite *Anguillicola crassus* is today frequently found along the east coast, occasionally along the west coast and in some freshwater lakes formerly stocked with yellow eel from the west coast. Diseases such as the 'red disease' and the cauliflower tumour occur now and then and the former one resulted in high mortalities in the Baltic some years ago.

Denmark - **Michael Pedersen**

Glass eel / elver

Following the collapse in glass eel recruitment to the Danish coast, fishing for glass eels ceased in the late 1980s. Glass eels are imported mainly from France and used for intensive eel culture with a production of approximately 1,000 t per year, for consumption.

Due to declining catches of eel, a stocking programme, financed by licences, has developed. Cultured eels of weight range 2 - 5 g are stocked in both marine and inland waters. The stocking programme began in 1987 and in 1994 a total of 7.4 million eels were stocked.

Yellow eel / silver eel

The official figure for catch in 1994 was 631 t of yellow and 509 t of silver eel. The catch has declined by about 50 % compared to the years 1978-1983. Data on catch per unit effort as well as indications of poor recruitment indicate that the dramatic decline in catch was caused by reduction of stock.

Yellow eels are exploited mainly by fyke and pound nets during the summer. Silver eels migrating in autumn are exploited by large pound nets along the coast. The silver eel migration from the Baltic is very important and supplements local populations. In inland waters, silver eels are caught in weir traps at the outlet of lakes. The minimum legal size of yellow eel in inland waters is 45 cm. In coastal waters it varies by local agreement from 29.5 to 38 cm.

Inland eel stocks are exploited by local landowners and comprise about 9 % of the total eel fishery. In coastal waters a licence system for professional fishermen has recently been established. The number of licences in 1994 was 32,000. These occasional and recreational fishermen are permitted to use 6 gear units (eg 6 fyke nets) and the majority are believed to fish for eels. Assuming that the average fisherman in this group catches 10 kg of eel per year, and these eels are used for private consumption or sold to neighbours, 320 t would not appear in the official statistics. This estimate is believed to be the minimum figure for the unrecorded catch.

Angling

Sport fishing for eel with a rod seems insignificant.

Public perception of eel fishing

The pound net fisheries along the Danish coast, which in 1994 made up some 440 fisheries, would not survive without the income from eel fishing. In rivers and lakes eel catches are equally important, although failing recruitment of elvers has changed the target species in lakes more towards pike and pikeperch. A general trend seems to be that eel fishing is changing from a professional fishery towards a recreational and occasional fishery.

Trade, processing and consumption

Eels are widely eaten in Denmark either smoked or fried. The majority of eels caught or raised in aquaculture in Denmark are believed to be exported as smoked or non processed eels.

Contamination
No systematic studies have been made, but it is believed that contamination in general is negligible. Restriction on consumption is at present in force on one river system, Grindsted å, due to heavy metal contamination in the 1970s.

Parasites/diseases
Anguillicola crassus is widely distributed in all waters. The red disease (Vibriosis) is an occasional problem which can occur in the spring, especially after severe winters.

Ireland (Northern Ireland) - **Robert Rosell**

Glass eel / elver
There are no fisheries for glass eel, other than a capture operation at the tidal limit of the Bann Estuary to transport elvers to Lough Neagh on the same system.

Bootlace eels
No fisheries are known to exist. Legal size limits would prevent such fishing.

Yellow eels
The longline fishery for yellow eels in Lough Neagh is an important source of employment (400 to 500 full-time and part-time jobs) and produces in excess of 500 t per year for the fishermen's co-operative which owns the rights to the fishery. A smaller fishery in government ownership on the two major lakes on the Erne system produces about 30 t per year for around 30 licensees. Relatively small-scale fyke net fishing also takes place on the Erne System.

Silver eels
Both the Bann / Lough Neagh and Erne systems also have commercial silver eel fisheries based on traditional eel weirs and fixed wing-nets respectively. These produce fewer eels than the longline operations in these systems, but are still highly significant with a combined catch of around 180 t, the bulk of which is from the Bann system.

Angling
Anglers have little interest in eel fishing.

Trade, processing and consumption
Almost all eels caught are exported to continental Europe without further processing.

Public perception of eel fishing
Eel fishing is economically the most important commercial freshwater fishery and, in revenue and employment terms, is seen as important.

Contamination
Levels of pesticides, heavy metals and organochlorines are negligible in all commercial fisheries. At one unfished site, the River Lagan at Belfast, these contaminants have occurred at levels which would prevent commercial use - but this is a small river with no eel fishery interest and a history of high urban and industrial impact. Eels are routinely monitored for contaminants as part of a UK-wide programme.

Parasites and diseases
Low incidences of nematodes, acanthocephalans and occasional ectoparasites are on record but there have been no cases of serious infestation. *Anguillicola* has not been recorded in Ireland. Records of disease have been few and extremely localised. Vibriosis and *Pseudomonas* have occasionally been diagnosed.

Ireland (Republic) - Christopher Moriarty and Julian Reynolds

Glass eel / elver
The capture or possession of the "fry" of eels is forbidden by law. Anecdotal information from the 19th century tells of the use of elvers as fertiliser but there is no tradition of the use of elvers for food or for export.

Between 1905 and 1910, reports on the arrival of elvers from rivers in all parts of the country were made. In 1959 capture of ascending elvers for overland transport within the river system began in the Shannon and, the following year, a similar operation was established in the Erne. Elver passes have been operated from time to time in other river systems, but without any consistency.

Permits to capture elvers which over-ride the legal prohibition can be granted by the national fishery authority. These permits allow retention of the entire catch in rivers on which there is no fishery for larger eels. In other rivers, 50% of the catch must be transported upstream to suitable habitats for growing eels.

Elvers are captured close to the tidal boundary in all cases. No fisheries exist in the lower parts of estuaries.

All elvers captured must be used either for stocking natural waters or for aquaculture. Sale for export or for human consumption is not permitted. The total catch of elvers has never exceeded 8 t.

Bootlace eels
Bootlace eels are captured at one fishery, incorporated in a salmon pass on the River Shannon. All are transported overland to lakes on the same river system. There are persistent rumours of capture of bootlace eels in estuaries on the south coast for export to aquaculture interests in other countries. These rumours have not been substantiated.

Yellow eels
Yellow eels are exploited by long-line, small fyke net and, to a much lesser degree, by baited pots in estuaries. Experiments with baited pots in fresh water have not been successful.

The biggest fishery in the state is that of the lakes and tributaries on the River Shannon. The fishing rights are held by the Electricity Supply Board (ESB) which operates hydro-stations in its lower reaches. Management practice from 1959 to the mid 1980s prohibited fishing for yellow eels. Widespread illegal fishing took place, however, with a supposed yield of 250 tonnes per annum. Following small-scale development of fyke net fishing in the 1980s, the

ESB decided to issue permits to an increasing number of fyke net crews, 37 2-man crews operating 50 nets each in 1995. The total catch for the year was 55 tonnes.

Fyke nets are used to a small extent in other lakes. Long-line fishing takes place in the lakes of the Erne System, with about 35 licences issued. The catch appears to be small, probably less than 10 tonnes.

The only other established fisheries for yellow eel are in the estuaries of the Rivers Slaney and Suir in the south-east of the country. Total catch is believed to be less than 30 tonnes per annum.

Silver eels
All silver eels are caught in rivers, the great majority in rivers which drain major lake systems. The usual gear is a barrage of stow nets attached to stakes set in the river bed. The law requires that 10% of the width of the river be left free from nets. Total catch in the season does not appear to be more than 75 tonnes.

Angling
A survey by questionnaire, published in 1988, calculated a catch of 275,000 eel of average weight 400 g, total 110 tonne. The sport is largely confined to tourist anglers and is considered to be expanding in importance.

Trade, processing and consumption
Virtually all eels are exported, mainly to Germany and The Netherlands. Local consumption is negligible and there is no processing industry. Eels are unobtainable in fish shops. As there is a ready market for eels for export, the authorities have never made any attempt to encourage development of home consumption.

Public perception of eel fishing
In some fishery regions conflict between the local fishery authorities and elver fishing interests has arisen, based on the local belief that the elver is an important item in the diet of the trout and elver fishing has an adverse effect on trout stocks. This hypothesis has never been tested and is not accepted as reasonable by the central authorities.

Eel fishing is the only form of commercial fishing allowed in inland waters throughout the country. Sport fishing by rod and line is popularly regarded as the only acceptable form of exploitation of freshwater fish and conflict arises between promoters of sport fishing - mainly in the interests of tourism - and the eel fishermen. Although extensive experimentation and observation indicate that fishing for yellow eel is fully compatible with sport fishing, there is a widely-held view that the primary interest of eel fishermen is to catch trout, pike and other species. As a result, there is little enthusiasm for developing the eel fishery except in regions where it has been established for a long time.

Contamination
Levels of pesticides and heavy metals in Irish inland waters are extremely low and there is no reason to believe that contamination poses a problem.

Parasites and diseases
Low incidences of nematodes, acanthocephalans and occasional ectoparasites are on record but there have been no cases of serious infestation. *Anguillicola* has not been recorded in Ireland. Records of disease have been few and extremely localised. Vibriosis and *Pseudomonas* have occasionally been diagnosed.

Great Britain - **Brian Knights**

Glass eels / elvers
There are historical records of large glass eel migrations into many rivers, especially the Severn and Thames. Migrations into urbanised estuaries were probably badly affected by gross pollution effects following the Industrial Revolution. However, improving water quality in estuaries such as the Thames have not been correlated with marked increases in migrations. Export and other data indicate recruitment has fallen drastically since the late 1970s-early 1980s. Research suggests an association with changes in N. Atlantic currents, affecting the migration of leptocephali from the Sargasso Sea.

A commercial fishery developed in the 1940s in the Severn Estuary, expanding greatly in the 1970s with increasing demands for restocking and, especially, aquaculture in UK and Europe. Hand-held dip nets are used during the migration season by about 500 part-time fishermen licensed by the National Rivers Authority Severn-Trend Region. The excess of demand over supply for top quality glass eels has caused prices to increase, encouraging fishing in other rivers with lesser runs. Catches are sold to one major and a few minor dealers who ship them (mainly by air) to warm-water eel farms, mainly in Scandinavia. Some are grown on for export as bootlace juvenile eels. High costs have discouraged sales for stocking to Eastern Europe. Only small occasional stockings are known to have been made in rivers in England. Catch-return data for glass eel fisheries are of poor quality but export data suggest catches are currently in the region of 20t per year, worth about 1.2 million ECU. This compares with estimated peak catches of 40-50t per year in the late 1970s.

Bootlace eels
No fishery exists for small juveniles. Research indicates upriver migration is very temperature-dependent and is adversely affected by weir and similar barriers in rivers like the Severn, Avon and Thames.

Yellow / silver eels
Historical data suggest large catches were made, but now few fixed rack, buck and mill-traps remain and catches are believed to be very small. Widespread but poorly-understood and regulated fyke-net fisheries exist, exploiting eels in still-water, rivers and estuaries. Some pair-trawling is also known to occur in some coastal areas. From catch-returns, the National Rivers Authority (NRA) estimated the catch for England and Wales in 1994 to be about 87t. Catch-return data are, however, incomplete and unreliable and estimates have varied between 40 and 300t per year in recent years. Export and other data suggest that the annual catch (fresh and frozen) is currently about 300t but could have been as high as 1000t in the late 1970s early 1980s.

Eel fisheries developed in the 1970-80s in the Thames Estuary as water quality improved, mainly involving fyke-netting, plus a few traps and pair trawlers. According to returns from fyke-net fishermen licensed by NRA-Thames Region, catches fell from about 9-11t in the early 1980s to about 3-4t in the 1990s. This mainly reflects differences in fishing effort, however, catches per unit effort (CPUE) generally averaging 0.4 kg/end/night each year. The recorded 1994 catch was 8.5t (CPUE 0.7 kg/end/night). NRA Southern Region have recently made greater efforts to license the fisheries in southern estuaries, leading to increases in estimates of the numbers of fishermen (now about 80). Annual catch estimates have risen from 30t in the late 1980s to >100t in 1995. Catches in upland areas of Wales and Scotland are believed to be relatively small (about 10t per year).

Aquaculture

A number of attempts were made in the 1980s to culture eels intensively in warm-water effluents from power stations and process industries. These closed because of technical and biological problems (e.g. maintenance of water supply , temperature and quality, feeding difficulties and differential growth rates). One closed circuit farm is known to be currently functioning successfully in Scotland.

Consumption

Some eels are consumed locally (e.g. as jellied eels in the London area) and some are imported (e.g. live from Ireland and frozen from Australasia) but a relatively large proportion of the catch is exported for smoking, particularly to Germany and the Netherlands, depending on relative market values during the year.

Public perception of eel fisheries

There is little knowledge of or interest in eel fisheries, except locally (e.g. in the Severn and allied glass eel fisheries). Eel is not important as a recreational angling fish. Glass eel fishermen come from all employments and only fish at night during the season. Some fyke-netsmen spend most of the season fishing but have other employment during the rest of the year. The numbers of people associated with eel fishing and allied industries are relatively small and, of these, many only work specifically with eels during the catching season.

Contamination

Contamination with organochlorines and heavy metals has been researched and is monitored by the Ministry of Agriculture, Fisheries and Food. Contamination has been found in localised areas (e.g. in East Anglia and in a West Country river contaminated with dieldrin used as a flower bulb and seed potato dressing). With improvements in pollution control and the banning of persistent EC black list pesticides, levels have been decreasing. Levels of dieldrin in Thames eels were found to be high enough in the late 1980s to issue a warning to control consumption but no such drastic measures have been needed since.

Parasites and disease

Studies have shown *Anguillicola* infestations to be widespread but there has been no evidence of deleterious effects. No other important disease problems have been experienced.

Netherlands - **Willem Dekker**

Glass eel / elver

The capture or possession of eels below 280 mm in length is forbidden by law. Consequently, the capture or possession of glass eels is forbidden. Since the early 1970s, the Organization for the Improvement of Inland Fisheries (OVB), which is instituted by the Fisheries Law, is permitted to catch 3 t of glass eels for restocking, at Kornwerderzand (53°04'N 5°18'E), near the sluices at the east side of the Afsluitdijk, the dam separating the IJsselmeer from the Waddensea. Since at the end of the 1980s these 3 tonnes were never actually caught and the restriction to just one site was lifted: the OVB is allowed to capture glass eels at 6 sites, 500 kg each. The IJsselmeer fisheries organisations have objected, because of the relative increase of the impact on the stocks. The Minister of Fisheries decided, in 1995, to allow a catch of 5 % of the total glass eel stock, but the total stock size is only known to a first, rough order of magnitude (5 tonnes). Dedicated research is planned in 1996.

One fisherman in Zeeland (51°22 3°45) has a permit to capture glass eels for local stocking. His catches are very restricted. Illegal catches of glass eels are known, but are certainly not of lasting importance.

Bootlace eels

Capture of bootlace eel is prohibited by the minimum legal size of 280 mm. The OVB has permission to process a limited amount (40 tonnes) for restocking. Additionally, there is an illegal standing practice of local transportation of bootlace eels by fishermen throughout the country. These rarely exceed the accidental bycatch of bootlace eel; in most cases the bootlace are just transported to the other side of the dyke where they were caught. A few cases are well documented, catch records spanning an interval of 40 years. In the mid 1980s RIVO-DLO, in co-operation with local fishermen in Loosdrecht (52°10'N 5°05'E), have developed a dedicated bootlace capture device, applicable in situations where polder water levels are below the surrounding water levels. This innovation has not found a widespread application, probably because of the common, but outdated policy to depend on natural immigration of bootlace, and a general neglect of the economical objectives of the eel fisheries by the water managers.

Yellow eels

Yellow eels are exploited by fyke nets, and to a lesser extend by eel boxes, long lines, baited single hooks, pond nets, stow nets, etc.

The single largest fishery is situated on Lake IJsselmeer, a former estuary of 1,820 km^2 closed off from the Waddensea in 1932. This fishery is state owned; approximately 100 companies are licensed to use an individually confined number of gears. Annual catches declined from over 1,000 tonnes in the 1960s to less than 250 tonnes in the mid 1990s. It has been shown that the decline in glass eel recruitment has caused a sharp drop of the yield in the nineties. The state-owned research institute RIVO-DLO has kept very detailed records of the size and composition of the commercial catches, and of independent stock surveys, from the 1970s onwards, but glass eel records date back as far as 1938. Annually, a stock assessment report is published, covering the eel, smelt, perch and pikeperch fisheries and 4 non-commercial species. The estimated fishing mortality in the eel fishery is 0.45, which is about four times the estimated optimum.

Bycatches of perch and pikeperch in the eel fishery dominate the exploitation of these coarse fish stocks. Predation by cormorants on eel has been shown to be of minor importance. The government is introducing joint management of the fisheries, by the state and the fishermen's organisations together, on Lake Ijsselmeer.

The yellow eel fisheries in coastal waters and in the rest of the inland waters are well known, but no records are kept anywhere. In the 1980s, the volume of these fisheries was estimated to be approximately equal to that of the IJsselmeer fishery. There is some evidence that the expected drop in yield following the recruitment failure in the 1980s, has still not occurred in these fisheries, but extremely low abundance of bootlace eels indicates that it is likely to occur in the near future. Circumstantial evidence indicates that overfishing is probably not as intensive as in the IJsselmeer fisheries, but in some areas it is certainly an increasing problem.

Silver eels

The relative importance of the silver eel fisheries in comparison to the yellow eel fisheries is declining, mostly because of the intense, and increasing, overfishing of the yellow eel stocks. The silver eel fishery on Lake IJsselmeer comprised more than 20 % of the total landings in the 1960s, but amounts to less than 5 % nowadays. In other waters, the silver eel fishery is of more importance. No records are kept there.

Angling

Eels are the target of a rather specialised group of anglers, using bobbing, a bunch of worms, on a thread without hooks. Other anglers predominantly fish for coarse fish, but do catch eels. The amount of eels caught is unknown; eels are a well respected part of the catch.

Trade, processing and consumption

The trade and processing of eels in the Netherlands is famous throughout Europe. Imports and exports are not well separated from the internal market. There is a tendency to label all trade as local catch (IJsselmeer), and to apply additives (oil) when the difference would otherwise be detectable for the consumer. No records are kept of processing and exports.

Public perception

The eel, and its fisheries, are in high esteem, but the public is not at all aware of the actual problems in the eel stocks (recruitment) and fisheries (overfishing). Smoked eels of approx. 350 mm in length, sold during funfairs, are very popular. Additionally, there is a more high priced market for fillets of larger smoked eels. The traditional eel fisheries and smokeries are exploited as tourist attractions (e.g. Volendam, a traditional fishing village near Amsterdam). The basic biology of the eel is widely and wrongly known by the public (scavenging, Sargasso sea, etc.).

Contamination

Pesticide and contaminant loads present only localised problems. In particular, the silver eels in the River Rhine are contaminated. Fisheries in these waters are not prohibited, but trading of the resulting catches is indeed. The public is quite aware of contaminations in eel, but no distinction is made between those caught in polluted and cleaner water bodies.

Parasites and diseases
Anguillicola is found throughout the country since the mid 1980s, but less severely so in the 1990s. Following widespread publicity in the 1980s, the problem seems to have been accepted. Red disease (Vibriosis) is reported locally during droughts in summer, in water bodies with limited circulation.

Germany - Eka Hahlbeck and Holmer Kuhlmann

Glass eel / elver
Capture of glass eel requires special permission. There is still one site for catching glass eels at the River Ems. The catch decreased from > 4 t in 1974 to < 3 t in 1980 and then very sharply to about 10 kg since 1983. Stocking with glass eels, imported mainly from France and Great Britain decreased from a maximum of about 12 t in the 1970s (old countries) to 6 t in the 1990s (old and new countries). The decline is due mainly to reduced supplies of wild stock, but there are additional causes in some localities. Stocking with pregrown elvers is increasing: 282 kg in 1989 to 3,899 kg in 1993.

Bootlace eels
Bootlace eels are mainly fished in the big rivers and in some lakes. In 1993 the total bootlace catch was 16 t in rivers (6% of total catch) and 1.7 t in lakes (0.4% of total catch). The figures are the summarised data from the old and new countries. For the old countries the amount of stocked bootlace decreased from 104 t in 1983 to 25 t in 1993.

Yellow eels / silver eels
The German statistics give no separate information for silver / yellow eels. Total catch for 1993 was estimated as:

North Sea coast	: 200 t
Baltic coast	: 320 t
Rivers	: 272 t
Lakes	: 406 t
Total	:1198 t

Figures do not include the recreational fishery (anglers). Its annual catch is estimated to be between 200 and 400 t.

The number of licences was 587 in the inland fisheries in 1993. This figure refers to the number of enterprises, not gears. The number of licences, 74,000 in the marine fisheries in 1993, refers to gears. Based on the official census which takes place every ten years, the trend in fisheries can be summarised as follows:

1) The total number of licences is declining.
2) An especially strong decline is to be seen in the number of river-licences.
3) To the same extent as the number of licences declined, the fished area per licence increased (doubled) in the inland fisheries. As a result of this the catch per licence increased.
4) Nevertheless the catch per ha decreased from 3.51 kg in 1982 to 2.23 kg in 1993.

No information on fishing effort is available. So it cannot be judged to what extent this decline is caused by stock reduction or decreasing effort.

Trade, processing and consumption
In 1993 the total consumption was 4,502 t (Production plus import minus bootlace minus export). The import from 20 countries (7 EU, 8 outside EU, 5 overseas) was about three times the national production. More than 85% of the eels are smoked.

Public perception of eel fishing
Without the eel fishery, most of the coastal marine and the entire professional inland fishery could not survive. In addition, eel is an important target species for the recreational fishery.

Contamination
In general contamination has decreased within the last five years. Nevertheless due to high content of heavy metals and pesticides in some rivers or parts of rivers, the selling of eels for human consumption is restricted or even forbidden. (e.g. Elbe, Rhine).

Parasites and diseases
Over the whole fishing area (freshwater and Baltic area) infestation with *Anguillicola* was reported, but infected eels were in good condition. Damaged swim bladders are found to a certain extent and may have an influence on spawning migration. Further control of the impact of *Anguillicola* on the eel stock is considered to be essential.

France - Yves Desaunay and Guy Fontenelle

Glass eel / elvers :
There is a long history of glass eel / elver exploitation throughout the Atlantic coast and, more locally on the Channel coast, at least from the beginning of the 20th century. Glass eel fishing is still prohibited in the Mediterranean waters.

Over this period, the market was mainly for export to Spain for direct consumption. From the 1960s, the fishing techniques improved in terms of fishing efficiency and the commercial fishery took a major place. In the last ten years, professional fishermen progressively organised their own regulation system and defined technical limitations to limit their overlapping and prevent overexploitation. However, the official statistics are not reliable on the national level (difficult to estimate: dispersed, individual small scale fishery, small fishing-gear, no centralised auction system) and illegal fishing and marketing are still a serious problem. Nevertheless, the organised commercial fishery in estuaries and in big rivers (Loire, Gironde, Adour) constitutes the major income for many coastal fishermen who cannot work in the open sea during winter. The fishing season lasts for 3 or 4 months between October and April, with local (latitudinal) variation.

Very small (unknown) quantities of live glass eels are also exported for restocking programmes in some northern or eastern European countries. Recently a huge demand from Asian countries arose for intensive aquaculture purposes.

Since the early 1980s, a continuous decline in glass eel catches and CPUE has been observed, under a stabilised fishing effort.

Yellow eels :
Commercial fisheries are very few in fresh water and they are of moderate importance in coastal waters (few on the Channel coast, occasional on the Atlantic coast, but traditional and sustained in the Mediterranean lagoons). In the Atlantic estuaries fishermen usually use mainly pots and, locally, eel trawls. Freshwater drainable ponds are used as extensive culture systems, with less than 50 kg / ha. Fyke nets are the traditional gear in the Mediterranean lagoons where the eel is a target species.

Aquaculture is very scattered in French territory as extensive practices (in ponds and marine or brackish coastal marshes associated with other species). Intensive ventures have been tried but, so far, all of them have led to economic failure because the high density and growth rate induced weight limit to less than 120 g while, for an economic return for such investments, the weight attained needed to be more than 200 g.

The density of yellow eels and the areas inhabited by the eels have drastically decreased in all watersheds in France while this species was the dominant one in many.

Silver eels
It seems that traditional small fisheries (at mill weirs) progressively disappeared, while restricted fisheries are still operated in great rivers and estuaries during late autumn and winter floods when the eels migrate. Very little is known about these catches in France. Severe injury and death are reported on these migrating eels after passing through turbines and hydroelectric plants.

Angling
Recreational fisheries are commonly practised in most of the habitats (mainly by rod and line, sometimes by pot) but the eel is not really a target species and no catch or effort data are available.

Public perception of eel fishing
The eel has never been a major product for the market in France, which may explain why no regulation or registration system has ever been applied on a national basis. Both administrations in charge of marine and inland resources traditionally excluded the eel from their proper field of interest. Very recently, these administrations improved their outlook, establishing common regulation systems in mixed estuarine waters, where most of the eel fisheries take place.

For a long time, the eel was considered as a noxious species in fresh water. Since the early 1980s this has no longer been the case. More favourable consideration by all management agencies has improved its status. The eel is now considered to be a valuable biological, sociological and economic resource.

A National Programme has been set up to co-ordinate the research. Some interesting observations have been made for all stages about migration features, age structure validation

and habitat discrimination, fisheries parameters (catches, CPUE), physiology (growth and reproductive hormones), design of new eel-pass facilities.

Watershed management approach (pilot watershed) is being proposed as a way to improve research and management (Vilaine River, Adour River, Grandlieu Lake). Unfortunately, in spite of the eel's recognised status, there is not yet an organised and funded research programme.

Trade, processing and consumption

Most of the catches of Mediterranean coast eel are exported alive to Italy when small sized (this trend is supposed to be induced by overfishing). For larger eels, exports are mainly directed to Germany, Belgium or the Netherlands.

Contamination / parasites / diseases

A national survey has been set up to estimate the distribution of the non-indigenous parasite *Anguillicola* that is now spread throughout France, and to study contamination by heavy metals and pesticides.

Portugal - Maria Assunçao Santos

Glass eel / elver

The Portuguese regulations for the glass eel fishery consider only the water bodies under tidal influence, since this activity is not allowed in the freshwater part of the rivers.

The River Minho is the most important Portuguese river for the glass eel fishery. This is due to the fact that both Portuguese and Spanish fishermen are using hamennet (tela) specially allowed in this area. In the rest of the Portuguese territory, fishermen may capture glass eels from the river bank by means of a dipnet only, but the illegal use of hamennet is still common in some rivers.

According to the data of the local commercial glass eel fishery on the Minho, the yield was over 20 tonnes per year in the period from 1976 to 1984 and then decreased in subsequent years. Since 1985 there have been variations from 14 tons in 1986 to 8 tons in 1988. At presesnt the official figures indicate that about 5 tons of glass eels per year are captured in the River Minho. Besides the fact that the yield has decreased, particularly in the second half of the decade of the eighties, this fishery still represents one of the main resources of income for the local people, even though this activity can only be practised during 6 months of the year.

The official statistics of capture are believed to be underestimates and an efficient control is hardly possible due to the uncertain number of non-professional fishermen.

Bootlace, yellow and silver eels

There are no fishermen in Portugal who depend exclusively on incomes provided by eel fishing. Different kinds of gears are used according to the region. In the north, lines and rods are common and permitted all the year round. In the centre and south, including coastal lagoons, traps are preferred but their use is restricted to three months of the year (September to November).

Official figures are once again not reliable since the majority of catches are not declared, so the numbers captured are underestimated. The legal minimum size allowed in Portugal is 200 mm. The silver eel was never a target for the Portuguese fishermen, but numerous dams prevent their migration.

Consumption
Virtually all glass eels captured in Portugal are delivered to buying agents who take care of weighing and further transport to Spain where 90% are provided for human consumption.

On the Portuguese market there is a deficit for eels, particularly with a weight of 25 to 65g which are especially used in the canning industry. In some regions, the traditional gastronomy has a high demand on eel.

Public perception of eel fishing
The high incomes of the glass eel fishery, now limited by the decrease of recruitment, still attract fishermen and non-professionals. It is extremely difficult to evaluate the importance of sport fishing because the yellow eel does not count in contests, for example. However, catches by 250 thousand licensed fishermen should not be neglected.

Besides the fact that hydroelectric impoundments are installed along the principal rivers of Portugal, the eel was never considered for restocking as are trout and bass.

Aquaculture
The first semi-extensive farms date back to the early 1980s, but so far the Portuguese eelculture production is poor. At present 4 farms are functioning and they produce an estimated 100 t per year. One closed-circuit far was built and designed to use hot spring water but remains inoperative due to bureaucratic problems.

Contamination
Generally, there is no treatment of sewage before introduction into Portuguese rivers. Some studies were made about the contamination of molluscs with pesticides and heavy metals, but the eels were not considered.

Parasites / Diseases
Anguillicola crassus was detected for the first time in 1992 in the lagoon 'Ria de Aveiro' in the north of Portugal, then in the more southern Rivers Mondego, Liz and Tejo in 1993. Unpublished works reveal that this parasite invaded already the water courses around Oporto, and studies will now be initiated in the River Minho. Other infestations by *Myxidium* and bacterial infections by *Aeromonas hydrophila, Pseudomonas fluoresces* and *P. putrifaciens* were also detected.

Spain - Maria Lara

Glass eel / elver
Glass eel is fished on all coasts, but mainly in the Atlantic. There is a strong tradition for glass eel consumption and Spain is the main consumer in Europe and perhaps in the world. It is known that the glass eel is fished in all river mouths and estuaries on the northern Atlantic

coast and in some on the southern. Complete information is obtainable only in one case, the Nalón Estuary in Asturias. Catches from 1990 to 1994 have been around 10 t (7.2, 10.2, 9.7, 9.9 and 12.5). By extrapolation the total catch for the Atlantic coasts of Spain is estimated as 150t On the Mediterranean coast, glass eel are fished mainly in the channels entering coastal lagoons and in river mouths such as the Ebro Delta. An annual catch of 50 t for the whole Mediterranean coast is estimated.

Bootlace / yellow / silver eels
Official figures of eel catch do not distinguish between yellow and silver eel. Fishing takes place mainly on the Mediterranean coast, mostly in lagoons, but there is some eel fishing on the southern Atlantic coast in zones of salt marshes. Total catches of yellow and silver eel in Spain are estimated as around 100 t.

Official figures for Mediterranean coastal fisheries, believed to be underestimates are:

	t
Ebo Delta	69
Albufera Lagoon	10
Mar Menor Lagoon	61
S'Albufera Lagoon	2

These figures do not include sport or recreational fishermen which, in the case of the glass eel, are likely to be very important. No control exists on these catches.

Angling
On the north Atlantic coast, eel fishing is occasional and is practised by some anglers for their own consumption.

Trade, processing and consumption
In Spain all glass eels are directed towards human consumption and the country imports the main glass eel production from France, Portugal, Morocco and probably from other countries. There are no data about the quantities of glass eel consumed. The median price per kg of glass eel during the season is 94 ECU.

A small proportion of the eels caught in the Mediterranean lagoons are consumed locally, the majority are exported alive. Some glass eels are exported frozen after boiling to Mexico and the USA.

One eel culture installation near Valencia produces about 100 t per year and exports to Holland, Germany and Japan.

Public perception of eel fisheries
Only a small number of fishermen (statistics not available) make a living from the glass eel fishery. The majority are part-time eel fishermen. In recent years, because unemployment has been rising rapidly in Spain, significant numbers of people have engaged in glass eel fishing. This is only an occasional fishery, taking place for a few days in each month of the season.

Contamination
During the 1960s and '70s, the majority of Spanish rivers had undergone degradation. Dams constructed without passes for migrating fish were the cause of eel disappearing from many inland waters. In recent years, coastal lagoons had been reduced in area because of increasing agriculture and in these lagoons and in many rivers pollution had increased. This pollution from industry and agriculture could affect seriously the eel habitat. At present plans are being drawn up to reduce pollution.

Parasites and disease
No research on these topics has been carried out. *Anguillicola* has not been observed.

Italy - from information supplied by Eleonora Ciccotti

Glass eel/elver
Glass eel and elver exploitation has a long tradition, dating probably to the 17th century as a basis for extensive culture in Adriatic lagoons. Exploitation has also been intense in the Tyrrhenian region, mainly in Tuscany and Latium, where glass eel were abundant, both at the mouths of large rivers such as Arno and Tiber and at smaller outlets including drainage channels and small rivers. Fishing required special licences and was carried out mainly with dip nets, the yield being used sometimes for seeding purposes but mostly for direct consumption - now illegal.

Glass eel fishing became more organised in the 1960s and 1970s, following the increased demand from the aquaculture sector following reduced natural ascent in coastal and lagoon environments. Problems in monitoring the catch exist because the fishing takes place in the transition zone between sea and inland waters: the former is under the administration of the Ministry of Agriculture, Food and Forest Resources while local provincial administrations regulate fisheries in inland waters.

In coastal waters and estuaries, annual authorisation by the Ministry is required and details of catch, location of fishing and end use of glass eel must be declared. Fishing is forbidden from 15 July to 15 September. Professional fishing for glass eel in inland waters requires a special authorisation stating details of the fishery and sales and end use of fry must be declared. The provincial administration can ask for a certain quota of the catch to be used for restocking purposes.

The greater part of the glass eel catch comes from the Tyrrhenian area where fishing is carried out by fyke nets with 2 mm mesh or by dip net. Glass eel for aquaculture has become less popular than weaned elvers (6 - 20 g) from France because of lower survival rates of the former. Current low yields of glass eel, however, are not capable of meeting the demand of the aquaculture sector. The demand over the period 1982 to 1990 increased from 2 to over 9 t but supply was unable to meet this. Since 1990, data have been scarce and irregular, corresponding with the fall in recruitment.

Yellow and silver eel
Most of the yield of yellow and silver eel fisheries comes from extensive culture in managed fisheries in many of the Italian coastal lagoons. These cover about 150,000 ha of which

approximately 61,000 ha are currently exploited. Of the exploited area, about 30,000 ha are located in the upper Adriatic and 12,000 in the Po delta. Yields as high as 75 and 324 kg per hectare have been recorded.

Valliculture, practised in the upper Adriatic lagoons is one of the oldest forms of aquaculture. It entails active fry stocking and hydraulic management. Fishing takes place at the *lavorieri,* traditional V-shaped traps. In other coastal lagoon environments, artisanal fisheries are carried out within the lagoons using, in addition to the barrier for silver eels, fyke nets, long-lines, traps and baskets. Management was in most cases based on natural fry ascent and often without hydraulic management. Ecological degradation has reduced the scope for management in recent times.

Eel fisheries in inland waters are carried out in large rivers and lakes, but inland fisheries play a minor role compared to the coastal lagoon fishery. The environment has undergone a series of impact actions including water pollution, installation of impassable dams and a general lack of management actions. Maintenance restockings are carried out by the provincial administrations. In the late 1980s between 11 and 12 t of glass eel and 15 and 22 t of larger eel were distributed over the whole national territory.

Intensive culture
Italy is the leading eel production country in Europe. The average aquaculture production fluctuates around 3,000 t of which in 1995 2,300 came from intensive culture and 700 t from extensive and semi-intensive. In intensive culture temperatures between 20°C and 28°C are used and stocking densities range from 0.5 to 20 kg per m^2. Imported weaned eel, 5 to 50 g, are the preferred feed. About six establishments in Italy are producing weaned eel from glass eel.

Consumption
Demand for the eel is high in Italy and consumption is probably the highest in Europe including substantial quantities imported.

Public perception of eel fishing:
Eel fishing enjoys an ancient tradition and is widely accepted.

Parasites/Diseases
The parasite *Argulus giordanii* had a serious effect on the whole Italian extensive eel production in the 1970s.

THE REGIONAL DATA INVENTORY

In the course of discussion during the author's preliminary visits to the participants, two questionnaires were compiled and, subsequently, circulated. The Data Inventory (Appendix 1) sought information from each country on a regional basis. The 'region' had to be very loosely defined. In the ideal cases a region was a single lake, estuary or river catchment. In others, a group of lakes or rivers or an extensive area of coastline could form a region and the extreme cases were those where all the lakes or rivers of a given country had to be taken together.

Data of varying degrees of accuracy were submitted for a total of 70 regions in 12 states. A summary of the results is given in Tables 1 through 5, under the following headings:

1. Catch, manpower, market and habitat
2. Gear, boats and status of fishermen
3. Dimensions of gear, management information

Catch, manpower, market and habitat

In Table 1, the quantities caught and manpower engaged are given under the main life stages. Catch per unit area and catch per fisherman and the value of the fishery are calculated. The market is described in terms of end use and status in the fishery: whether the eel is the main target, part of a mixed fishery or of minor importance. Under habitat, the geographical latitude and the type of water body are given, and an estimate is made of the number of months in the year when the temperature is greater than 10ºC.

The smaller catches were distributed amongst all habitat types. The larger catches, 100 t or more were recorded from seven coastal areas, two lakes, two coastal lagoons and one river. The highest yields per unit area were in the Italian coastal lagoons of Monaci (324 kg/ha and Orbetello (75 kg/ha), the French Mediterranean lagoons Ayrolles-Gruissan (52 kg/ha) and Albufera (50 kg/ha) and from the River Imsa in Norway (40 kg/ha). Yields between 10 and 22 kg/ha were observed in 4 lagoons, 3 estuaries and 1 lake.

Table 2 gives the value of total income per fisherman for the fisheries where the yield is 5 kg per ha or greater. High catches are made close to both extremes of the eel's climatic range. The Imsa in Norway is for silver eels only, caught by a highly efficient trap. Fishing mortality during the yellow stage would be negligible. In the French lagoons exploitation is largely at the yellow stage and the high catches are probably sustained by good recruitment and rapid growth rate. The Italian laggons are managed fisheries capturing yellow and silver eels. In the majority of cases elsewhere, yield per hectare and catch per fisherman are far below the highest known values.

Catches of 1 t and more per man were recorded from the River Imsa, two Swedish and two Irish lakes, the rivers of southern England and the lakes of Germany, in France, one lake, two estuaries and four lagoons and in Italy two lagoons. The highest catches of all, 3 t each, were made by two men fishing for yellow and silver eel in the Seine estuary, but this was nearly equalled by the average for 80 fishermen in the lagoon of Bages-Sigean which also recorded a high yield per hectare of 14 kg.

Table 3 selects the glass eel catch and gives its value in terms of total income and income per fisherman in 23 fisheries. In the Severn Estuary (Great Britain), 508 fishermen made an average catch of 35 kg, value 2,835 ECU per person. The Severn, the Nalon (Spain) and 5 of the 20 French estuaries recorded catches worth more than 1 million ECU per year and the average income per fisherman was as high as 35,000 ECU. A total of 2,588 fishermen caught 342 t of glass eel and the average income to each was 7,570 ECU. The greatest and most valuable catches all depended on the use of fishing boats and therefore required considerable investment. The Severn fishery, however, depends entirely on the operation of small dip nets

and, since it takes place only for a few days in each lunar period over a sort season, represents a very significant income in terms of labour input with trivial capital investment.

The maximum average earnings per fisherman (up to 35,000 ECU) are substantially higher in the glass eel fishery than in yellow and silver eel exploitation (up to 14,815 ECU).

Gear, boats and status of fishermen

Table 4 gives data on the types of gear in use. For glass eel and elver the dip net is the most popular. Traps, trawls and push nets for elvers are all localised and apparently associated with particular environmental conditions. For example, traps are used in Denmark and Ireland where power stations or barrages are located at the head of the tide. Push nets and trawls are used in the larger estuaries of the Bay of Biscay and farther south.

For yellow eel the fyke net is used throughout the area, but the long-line seems to be confined to the northern part. The eel pot is used in estuaries on the Atlantic coast and the pound net extensively in the Baltic.

The table gives a total of 6,229 licences. These provide some indication of the minimum numbers of people engaged in eel fishing, but the global list fails to distinguish between professional and recreation fishermen. Some estimates on the proportion of licensees who are professional is given in the next column. The general picture is of 100% professional in the northern countries, except in France where they appear to be in the minority in many, though by no means all, cases.

More than 3,000 boats are listed as engaged in the eel fishery. The majority are in the 7 - 9 metre range, with small boats next in importance. Nearly all the large ones, greater than 12 m, work in the Ijsselmeer. Over 2,000 bank fishermen have been recorded. It is likely that all these figures are underestimates.

Dimensions of gear, management information

Table 5 gives an indication of the most widely used dimensions for eel gear. Dip nets generally have a mouth diameter of 1.5 m. Fyke nets with mouth diameter greater than 50 cm are exceptional, though large ones are recorded from Lake Ijsselmeer (diameter up to 1.5 m is allowed). Long lines vary between 1,000 and 2,000 hooks Cod-end mesh is generally 12 mm, smaller in the French lagoons and estuaries.

Large minimum sizes, 550 mm, are in force in some Swedish lakes and in the Baltic. Smaller limits, usually 280 or 300 mm are widely, but very unevenly, distributed. The concept of mean weight is used in cases in France, with a limit of 22 per kg. A small minimum size, 200 mm, is allowed in Portugal. Few countries, however, have size limits throughout their jurisdiction.

THE SECTORAL DATA INVENTORY

The group compiled available data for four habitat sectors, coastal, estuarine, lagoon and inland under three headings:

- Physical and commercial influences on stock and catch
- Assessment of manpower, gear and catch
- Outline survey of fishing methods

Physical and commercial influences on stock and catch

Table 6 gives estimates of the area of water believed to produce eel and of the 'potential' area in which no fishery for eels takes place but which could be developed. Figures on management practices include data on stocking, on size limits, if any, and the current price per kg.

Productive water area

Most of the countries which have a coastal fishery for eel considered that the area of suitable marine habitat was fully exploited. Sweden, however, considered that the extent of the coastal fishery could be nearly doubled and Germany that it could be increased by a factor between 3 and 4.

Ireland was the only country which could estimate the area of productive estuarine water and considered that the fishery exploits all suitable habitats. The other countries were unable to supply data. The estuarine component, however, is unsatisfactory to quantify because the glass eel catch, the greater part of which is made in estuaries, does not necessarily depend on the surface area of the water.

No details on the extent of coastal lagoons in France, Spain and Portugal were available. While it is known that many lagoons sustain a substantial fishery, there is no information on whether the productive area could be increased by stocking or not.

Sweden considered that only about two thirds of the available lake area is productive and that very substantial increases could be made. Northern Ireland and Republic of Ireland both noted potential for an increase of 12%. Denmark and Netherlands both held that their productive waters were fully exploited. France was unable to quantify the extent of inland waters rendered inaccessible to eel by dams but showed that it is very extensive and that there is room for considerable expansion of the eel habitat.

Stocking

Stocking of coastal waters is not widely practised. Sweden transfers small yellow eel from the west coast to the Baltic; 63 t were stocked in this way in 1995. Denmark imports glass eel from France which are released after growth in culture to an average weight of 3.5 g, 21.5 t were stocked in 1994. In French estuaries there is small-scale transfer within and between estuaries, not more than 2 t being involved. No stocking is known to take place in the coastal lagoons.

In inland waters, stocking within river systems takes place in Sweden, the Netherlands and Ireland. A total of 13.25 t was recorded in 1994. Stocking between systems takes place on a larger scale, about 50 t in total in Sweden, Germany and Ireland. About 35 t of glass eel imports for stocking were recorded from Sweden, Denmark, Northern Ireland, the Netherlands and Germany.

Assessment of manpower, gear and catch

Table 7 attempts a country by country synopsis of the eel capture fishery. In assessing the numbers of fishermen, the group decided to define three categories of professional fishermen, fulltime, part-time and occasional, depending on the proportion of their annual income that derived from eels. A fourth category of 'recreational' covers individuals who catch eels for their own consumption and do not aim to sell any of their catch.

Boats were divided into large and small, with a length of 12 metres as the dividing line. This distinguishes between typical marine fishing boats and small inshore or inland craft. In the virtual absence of hard data, the figures for catch given are the best estimates which participants were able to make, based on personal knowledge of the industry in their countries.

Manpower

Sweden was the only country claiming to have coastal fishermen engaged fulltime. Ireland, with a total of 12 and the Netherlands, with 50, in inland waters brought the total of fulltime fishermen to 162.

Under the heading of 'part-time' very much more significant numbers appeared. The total in coastal waters was 2,640 of which all but 100 work on Baltic coasts. In a great many of these cases, the eel makes the difference between the fisherman's ability to continue in business or abandon fishing as a profession. Estuarine fishing was recorded on the Atlantic coasts. The total of 950 from France and Ireland can be substantially increased by unknown numbers in the estuaries of Spanish and Portuguese rivers. The lagoon fisheries of France, Spain and Portugal are know to be important but extremely little information is available. Inland waters provide the most comprehensive data and six states record substantial numbers of part-time eel fishermen.

Numbers of 'occasional' and 'recreational' eel fishermen are extremely difficult to assess and in such cases as Denmark, a firm distinction cannot be drawn. The numbers, however, are very considerable. Denmark estimated a total of 32,000 coastal and 1,500 inland fishermen in the two categories. In the Netherlands, there are half a million recreational fishermen. However small their catches of eel, these very large numbers of fishermen must make a substantial contribution to the total catch of the species. An economic survey in Ireland (Whelan & Walsh, 1988) calculated that recreational fishermen capture 110 t of eel per year - more than 50% of the officially recorded professional catch.

Numbers of boats

The greatest numbers of small boats used in eel fishing were on the Baltic coast of Germany and in the estuaries of France, approximately 1,000 in each. In Sweden the majority of the 423 licensed fishermen operate from one small boat (< 6 m) each. In Denmark the total is likely to

be some thousands. The same may be said of boat use in the Spanish and Portuguese estuaries. In inland waters some hundreds of small boats are in use.

Large vessels on the Baltic and Atlantic coasts are all involved in mixed fisheries and it is unlikely that any are used exclusively for eel. However, most of the large boats in the IJsselmeer in the Netherlands are dedicated to the eel fishery, with additional fisheries for coarse fish during the winter months only.

Catch

The largest known catches are those from the coastal fisheries of Sweden and Denmark and the lagoon fishery of the south of France and Italy. The next in importance are those of the lake fisheries of Northern Ireland and the Netherlands and the inland catches of France, Poland and Germany. In view of the high price of glass eel, however, it is likely that the most valuable catch is that of glass eels in the Bay of Biscay, valued at 18 million ECU in 1994 and followed by that of Spain where a higher price was recorded and the catch of 150 t was worth 14 million ECU. The most valuable fishery for yellow and silver eel, that of the Danish coastal waters, was worth between 5 and 7.5 million ECU.

Outline of fishing methods

Accurate data on fishing gear in use are almost impossible to obtain. Large numbers of occasional fishermen use a variety of gears, but they are widely distributed and only rarely subject to licence and control. Official records of the fishery concern themselves mainly with the total catch, sometimes with the numbers of people involved and only rarely with the gear used.

Glass eel

The dip net, operated from the river bank by a single person, is the most popular gear for glass eel fishing. France and Great Britain offer a good estimate, totalling 1,568 and some hundreds of operations are known from Spain and Portugal from which details are totally absent except in isolated cases where research studies are in progress. France records 216 trawl nets for glass eel and they are extensively used in Spain. In Portugal the hamennet, which works on the stownet principle, is permitted in the Rio Minho but used illegally elsewhere. The use of riverine fixed traps, in tidal water or in the lower reaches of rivers, is extensive in France but infrequent elsewhere.

Yellow eel

The coastal fisheries of Denmark and Sweden record the operation of 160,000 and 142,000 fyke nets respectively. The German coastal fishery had at least 24,600 eel pots and 444,000 longlines. In France, the trawl was the most important eel fishing gear on the coast.

In Ireland and France, considerable numbers of eel pots are used in river estuaries together with some hundreds of small fyke nets. The eel trawl is widely used in French estuaries. The lagoons of the French Mediterranean coast record large numbers of fyke nets and longlines. These are used also in Portugal and Spain but no numbers are available.

In fresh water, more than 25,000 pots and 35,000 small fyke nets are known to be in use. The longline is still popular in Sweden and Northern Ireland, but has generally declined in importance elsewhere.

Silver eel

The silver eel fishery is a very important one in the Baltic and on the Danish coasts, 5,000 pound nets being reported from the latter. Riverine gear is widely used, either in the form of mill dams with a provision to hold nets or screens or as specially constructed eel weirs holding nets. At least 643 pound nets are in use in the larger Swedish lakes.

EXPORT AND CONSUMPTION

The diagrams in Figures 1 through 3 show the estimated movement of eels within the participating countries, with an estimate of consumption in Italy. An unusual and important factor in the eel industry is the fact that significant quantities of eel are caught twice: first as glass eel or bootlace eel for ranching and finally as yellow and silver eel for consumption.

The main producers of glass eel are France and Spain, with one estimate of the catch totalling 782 tonne. The greater part of this is consumed in Spain, where less than 1% of the entire glass eel catch is used for ongrowing. The main importing countries for yellow and silver eel are seen to be the Netherlands and Germany.

In terms of quantity, the glass eel trade accounts for only 4% of production. But, because of the very high value, the glass eel trade is estimated to be worth one third of the production and in numbers of eels consumed accounts for 97%.

The strongly marked difference between estimates of production and consumption of yellow and silver eel suggests that about one third of the catch is unrecorded.

TEMPORAL TRENDS

A questionnaire (Appendix 2) to elicit personal opinions on changes in the fishery in the course of the 20th century was circulated to all participants and the replies are summarised in Table 9. Plus signs are used to indicate improvement and minus signs deterioration. Blank spaces indicate the absence of any known trend..

The three periods were chosen to display (i) longterm historical development, (ii) changes between 1970 and 1989 when major fluctuations of glass eel supply were observed and (iii) the most recent trends.

Between 1900 and 1969 positive developments of the fishery in four countries were observed, accompanied by deterioration the habitat resulting from pollution, land reclamation and the development of hydro-dams. The fisheries of Ireland (Republic), Great Britain and Portugal

increased between 1969 and 1989 and improvements in management were noted in five states. Habitat deterioration in general continued.

In the past five years, only Ireland (Republic) recorded an increase in the fishery. However, management improvements were widespread and habitat deterioration became much less frequent.

FAO YEARBOOK DATA

The values given for national catch of eels in the *FAO yearbook Fishery statistics: Catches and landings* (Anon. 1995) are the only officially published data giving an estimate of yield of the European eel fishery. The group examined the figures for 1993 and made the following observations under country headings:

Albania 210 t
The figure is greater than expected and may be an over-estimate. Lake Scutari is believed to be the only likely producer and the group made an estimate of 100 t.

Belarus 13 t
Production is probably greater than given as work on development of the fishery is in progress. No firm information is available.

Belgium 125 t
Aquaculture production is estimated as 100 t, leaving 25 t for the capture fishery a plausible figure. It should possibly be supplemented by sport fishery.

Croatia 5 t
The coastline is long and a higher catch might be expected. However, the extent of eel habitat is not known.

Czech Republic 32 t
With little or no natural immigration of young eel, the figure given is plausible.

Denmark 1,837 t
The official figure for inland waters was considered too high and for marine, too low. Data for 1994 were 1,357 t for marine, 100 for part-time fishermen and 320 for recreation making a total of 1,780 - close to the FAO 1993 figure. However, an estimated 1,000 t of production of cultured eel is omitted from the total which has therefore been raised to 2,780.

Estonia 59 t
Having both a Baltic coast and extensive lakes, the estimate of 59 t is considered to be very low. No official statistics are available for inland waters but Andu Kangur, a research worker, gave an estimate of 85 t for Lake Võrtsjärv. Official data from the Estonian Bord of Fisheries, supplied by Henn Ojaveer at the Estonian Marine Institute, give 6 t for 1995 and 10 t each for 1993 and 1994.

Finland 0 t
The catch had fallen to zero in the 1980s, but a stocking programme is redressing the situation and a figure of 10 t for 1994 was provided by Jouni Tulonen, a Finnish government scientist.

France 1,676 t
The figures for the Atlantic coast appear to be a serious underestimate since the catch of glass eels alone was estimated as 300 and no value was given for the substantial estuarine and coastal fishery, estimated as 500 t. A round-figure estimate of 1,000 to for the Mediterranean was made. The group therefore believes that the French catch has been underestimated by at least 1,000 t.

Germany 1,027 t
Unpublished official data indicated an underestimate of nearly 200 t for capture fisheries and these are increased in Table 10 to 800 t for inland waters and 400 t for the coast. Together with an aquaculture production of 100 t, this makes a total of 1,300 t A recreational catch, possibly as high as 1,000 t, is not reported.

Greece 354 t
On the assumption that this includes intensive culture and ranching, the estimate appears reasonable.

Hungary 263 t
Germany imported 244 t of eel from Hungary and the production figure therefore seems to be reasonable.

Ireland 150 t
The figure does not include an unreported fraction, believed to be very substantial. An estimate of 250 t for yellow and silver eel is believed to be closer to reality.

Italy 3,490 t
The total aquaculture production for Italy in 1992 has been estimated as 4,952 t: intensive 2,020 t and extensive 2,942 t. According to a time series from a different source, extensive culture in 1993 was 7% lower than 1992 and intensive slightly higher. By extrapolation a total for 1993 of 4,700 t is calculated. An estimate of 100 t for production from inland waters is also included in Table 10.

Latvia 18 t
The figure is plausible.

Lithuania 0 t
There is probably substantial eel production on the coast and possibly more in inland waters. Rimantas Repecka, Lithuanian Institute for Ecology, provided an official figure of 5.9 t for 1994, considered to be an underestimate.

Netherlands 418 t
Although the catch is decreasing rapidly, the figure is believed to be an underestimate. An aquaculture production of 1,500 t should be included.

Norway 340 t
A research worker, L. A. Vollestad estimates a catch of 405 t.

Poland 1,116 t
The figure is plausible.

Portugal 537 t
The figure cannot be confirmed, but is believed to be an underestimate.

Russian Federation 35 t
The figure is considered reasonable.

Slovakia 7 t
In the virtual absence of natural stocks, the figure is considered reasonable.

Spain 245 t
No official data are obtainable. The 'inland' figure probably indicates aquaculture production. The group considers a production of nearly 500 t to be a better estimate.

Sweden 1,336 t
The figures are reliable, 'inland' includes aquaculture.

Switzerland 4 t
Lake Constance is the only source.

Turkey 261 t
If the figure is valid, the source is likely to be aquaculture.

UK (England and Wales) 88 t
Figure is a serious underestimate, catch is estimated as at least 270 t.

UK (Northern Ireland) 662 t
A substantial catch is unrecorded, total is estimated as 735 t.

Yugoslavia 8 t
The figure is plausible.

Morocco 170 t
Believed to be a serious underestimate, 300 t is proposed on the basis of estimated imports by Spain and the extent of coastal lagoon.

Revised estimate of catches
An estimate of the actual catches, made by members of the group, is shown in Table 10. It appears that there is:

- a lack of consistency in the *Handbook* in including or omitting aquaculture production
- frequent under-reporting of commercial catches
- little or no attention paid to recreational catches

Furthermore, in spite of a recommendation made by EIFAC some years ago, the *Handbook* does not separate glass eel from yellow and silver eel. This omission, except in the cases where there is no glass eel fishery, makes it impossible even to estimate the value of the catch on the basis of the published data.

Compilation of Table 10 led to a 43% increase in the known yield of the species, from 14,800 to 21,200 t This was considered to be a conservative estimate since, in most cases, no additional facts on the commercial catch were available and data on recreational catch is based either on sample surveys or by simple extrapolation from known number of licensees and supposed annual catch by individuals. An estimate of 550 t, 3% of the total, was made for the glass eel catch.

CONCLUSIONS

The over-riding observation is that hard data on the eel are extremely scarce. Few countries were able to provide extensive detail on the fishery. The gathering together of the available facts serves more than anything to show the inadequacy of the information. Official returns are either completely lacking or suspect because of the reticence of many of the fishermen. Wide discrepancies exist between the official data, the best estimates which the group could make and estimates made by other workers. Because the group started with data of varying quality which could not be fully assessed, no attempt was made to reconcile the differences between the various estimates. In spite of this, some conclusions may be drawn.

1. The yield of European eel is very much greater than that shown in the FAO statistics. The group made an estimate of 22,000 t rather than 15,000 t. An independent assessment (Heinsbroek and Kamstra, 1994) considered that the total could be as high as 30,000 t. The value of the catch is distorted because the glass eels, 4% of the total by weight, account for 33% of the value. The value of the catch as paid to the fisherman was estimated at 180 M ECU and with value added as 375 M ECU.

2. Manpower engaged fulltime in eel fishing is relatively low, fewer than 500 individuals. Numbers engaged part-time or occasionally totalled 25,000. In a great many of these cases the eel catch makes the difference between a viable income from fishing and the need to abandon fishing and seek other employment. In others, particularly the 'occasional' fishery for glass eel, the few weeks of fishing provide low-paid individuals with a substantial part of their income. The eel therefore makes a sociological contribution out of all proportion to its cash value.

3. Observations on the small number of well-managed eel fisheries imply that there is enormous scope for development. Yields greater than 5 kg per hectare are attained in a variety of habitats throughout the region. The highest yields recorded were 324 kg per ha in one Italian coastal lagoon, 75 kg in another, 52 kg in a French Mediterranean lagoon and 40 kg per ha in a Norwegian river and lake system. However, the majority of yields were

less than 5 kg per ha. There is no apparent reason why the highest values could not be equalled if adequate management steps were to be taken.

4. Even in recent years when catches of glass eel have been regarded as exceptionally poor, immense numbers have been captured, of which more than 95% were killed for consumption. The implication is that adequate glass eels exist for a greatly enhanced stocking programme.

5. The working group study made in November 1995 covered the majority of European countries with a high production of eel. Data from Poland and Italy were obtained after the meeting of the group.

6. Many eel fisheries have declined in the course of the past twenty years, the principal factors appear to be recruitment failure and inadequate management measures.

7. Eel fishing can be undertaken with a low capital investment and provides important opportunities for work in communities where unemployment is high.

ACKNOWLEDGEMENTS

This paper is based mainly on information provided by the participants listed in Appendix 2 and considered at meetings funded by the European Union under its AIR scheme. Additional information was provided by Maria Bninska (Poland), Rimantas Repecka (Lithuania), Andu Kangur and Henn Ojaveer (Estonia) and Leif-Asbjorn Vollestad (Norway).

Table 1. Total catch, manpower, value and habitat from data inventory questionnaire. Pooling of data from two adjacent columns indicated by ampersand '&'. Total in 'Quantity' column omits glass eel catch.

	Quantity (tonne)					Manpower					Catch					Market			Habitat		
Region	Glass	Bootface	Yellow	Silver	Total	Glass	Bootface	Yellow	Silver	Total fishermen	Area (km^2)	kg/ha	kg/man	ECU per kg	Value ECU * 1000	Usage	Status in fishery	Exports %	Waterbody type	Warm months	Latitude
Norway																					
Imsa				4	4				3	3	1	40.0	1,333	6	24	cs	t		R	5	59
Skaggerak coast					400						1000	4.0		6	2400	c	t	100	CO	5	59
Sweden																					
Coast Blekinge			27	28	55						1850	0.3		6.2	341	c	t	72	CO	5	56
Coast Bohus			369	2	371					295	2500	0.1	1,258	<6.2	<2300	cs	t	78	CO	5	58
Coast Gavleborg*					4					30	11200	0.1	133	<6.2	<25	c	t(b)	10	CO	<5	63
Coast Halland			56	1	57					30	2300	0.1	1,900	<6.2	<353	cs	t+m	95	CO	5	57
Coast Kalmar			70	225	295					2000	3200	0.9	148	6.2	1829	c	t	65	CO	5	57
Coast Kristianstad			16	62	100					126	3200	0.3	800	6.2	620	c	t	67	CO	5	55
Coast Malmohus			22	53	75					220	5100	0.1	341	6.2	465	c	t	77	CO	5	55
Coast Ostergotland			13	77	90					200	1000	0.9	450	6.2	558	c	t	64	CO	5	58
Coast Sormland			34	4	38					1531	1000	0.1	25	6.2	236	c	t	91	CO	5	59
Coast Stockholm			6	54	60					37	4500	0.1	1,622	6.2	372	c	t(m)	77	CO	5	54
Coast Uppsala			1		1					10	1700	0.1	100	6.2	6	c	t	48	CO	5	60
Lake Hjalmaren			10	25	35					30	484	0.7	1,167	6.2	217	c	m(t)	96	L	5	59
Lake Malaren			7	43	50					55	872	0.6	909	6.2	310	c	t	86	L	5	59
Lake Vanern			6	19	25					291	2691	0.1	86	6.2	155	c	m(t)	81	L	5	59
Lakes Kristianstad			3	4	7					240	93	0.8	29	6.2	43	c	t	72	L	5	56
Lakes Kronoberg					20					250	382	0.5	80	6.2	124	c	t+m	na	L	5	57
Lakes Malmohus			18	17	35					320	77	4.5	109	6.2	217	c	t	48	L	5	55
Lakes Ostergotland			2	15	17					9	308	0.6	1,889	6.2	105	c	t	84	L	5	58
Lakes Skaraborg					5					10	15	3.3	500	6.2	31	c	t	77	L	5	58
Denmark																					
Fresh waters					142					200	600	2.4	710	6.25	888	c	t		RL	7	55
Marine waters					1808					660	7000	2.6	2,739	6.25	11300	c	t		CO	7	55
Harte/Tange		0.1					2			2			50			r	t	100	R	7	56
Ireland (Nth)																					
Lough Neagh			597	95	692			400	&	400	380	18.2	1,730	6	3582	c	t	100	L	6	54
Erne lakes			32	11	43			100	&	100	145	3.0	430	6	258	c	t	100	L	6	54
Ireland (Rep)																					
Shannon	0.3	0.1	55	38	93	1	1	72	10	82	300	3.1	1,134	4&5	410	c (s)	t	100	RL	7	54
Erne Lakes	2.4		10	2	12	1		70	2	70	50	2.4	171	4	50	c(s)	t	100	RL	7	54
Waterford Harbour			10		10			20		20	20	5.0	500	4	40	c	t	100	E		53
Wexford Harbour			10		10			20		20	15	6.7	500	4	40	c	t	100	E		53
Northwestern lakes			7	10	17			14	5	19	100	1.7	895	4	68	c	t	100	L		54
Great Britain																					
Severn	17.7					508							35	85	1530	a(c,s)	t	95	E	10	51
Thames Estuary			6.5		6.5			14		14			464		33	c	t,m		E		51
Southern rivers					136					92			1,478		680	c	t(b)		R		51
Netherlands																					
IJsselmeer					285					300	1820	1.6	950	5.5	1425	c(r)	t		L	6	52
Rest of NL inland					400					500	5000	0.8	800		2000	c	t		RL	6	52
Coast					200						5000	0.4			2000	c	b		CO	6	52
Germany																					
Baltic coast					450					650	1800	2.6	692	6	2700	c	t,m,b	&	CO	6	54
North Sea Coast					200					560	900	2.2	357	6	1200				CO		
Rivers		16	256	&	300						479			6	1200			&	R	6	53
Lakes		2	404		500					1434	1821	2.7	349	6	3000	cs	t	25	L	6	53
Poland																					
Sniardwy Co.			25	&	25			26	&	26	100	2.5	962	8	200	c	m	70	L	5	53
France																					
Arcachon yellow			33		33			24		93	156	2.1	355			c	t	na	CL	10	44
Arcachon glass	3					69					156	0.2	43	78	234	c	t	na	CL	10	44
Adour yellow			na		na			11			16000								ER		
Adour glass	2					63						0.1	32	65	130	c	t	90	ER	10	43
Ayrolles-Gruissan		&	68		68		&	34		34	13	52.3	2,000	5	340	ac	t	90	CL	6	43
Bages-Sigean		&	80		80		&	27		27	56	14.3	2,963	5	400				CL		
B du Mt St Michel	3.6		na			11		na		11	na	na	327	70	252	c	t	90	RCO		48
Rade de Brest	4		na		na	11				11			364	60	240	c	t	90	R	9	48
Baie de Seine Y			6		6			6		2	12000	<0.1	1,000	5	30	c	t	na	ECR	10	49

Table 1. *(Continued)*

	Quantity (tonne)					Manpower					Catch					Market			Habitat		
Region	Glass	Bootface	Yellow	Silver	Total	Glass	Bootface	Yellow	Silver	Total fishermen	Area (km^2)	kg/ha	kg/man	ECU per kg	Value ECU * 1000	Usage	Status in fishery	Exports %	Waterbody type	Warm months	Latitude
France (continued)																					
Baie de Seine G	1					45				45	12000	<0.1	22	60	60	c	t	na	ECR	10	49
Canet-St Nazaire		&	8		8		&	12		12	4.8	16.7	667	5	40	ac	t	90	CL	6	42
Pertuis Charentais			25		25			na		na	800	0.3		7	175	c	t	na	CO	10	46
Charente & Seudre			4		4			4		450	10	4.0	9	7	28	c	t	na	ER	10	45
Charente & Seudre	30					150				150	10	30.0	200	78	2340	c	t	na	ER	10	45
Douve R	0.2					1				1	1	2.0	230	60	12	c	t	na	R	10	49
Garonne			74		74			95		95	81	9.1	779	7	518	c	t	na	ER	10	45
Garonne	29					152				152	81	3.6	191	78	2262	c	t	na	ER	10	45
Gironde etc.			70		70			500		500	635	1.1	140	8	560	c	t	5	ER	9	45
Gironde etc.	70					565				565	635	1.1	124	60	4200	c	t	98	ER	9	45
Grand Lieu Lake			31	&	31			27	&	27	63	4.9	1,148	8	248	c	m	na	L	10	47
Loire Est & Ir riv			88	&	88			461	4	465	40	22.0	189	5	440	c	t	na	ER	10	47
Loire Est & Ir riv	77					253				253	40	19.3	304	60	4620	c	t	90	ER	10	47
Manche Occid.	5.5		na		na	11		na		11	na		500	70	385	c	t	90	ER	9	48
North Brittany	10		na		na	23		2		25	na		435	70	700	c	t	90	RE	9	48
Odet & Pont L'Ab	0.5		na		na	8		1		9	na		63	60	30	c	t	100	RE	10	47
Orne R	0.05					15				15	1	0.5	3	60	3	c	t	na	R	10	49
Etang Palavasiens		&	60		60		&	38		38	48	12.5	1,579	6	300	ac	t	90	CL	6	43
Risle R	0.02					1				1	1	0.2	20	60	1	c	t	na	R	10	49
Salses_Leucate		&	50		50		&	28		28	38	13.2	1,786	5	250	ac	t	90	CL	6	42
Seine Estuary			6	&	6			2		2	100	0.6	3,000	5	30	c	t	na	EC	10	49
Seine Estuary	0.6					45				45	100	0.1	13	60	36	c	t	na	EC	10	49
Vilaine			15	&	15			15	&	15	na	na	1,000	5	5	c	t	na	E	9	47
Vilaine	53					110				110	na	na	482	60	3180	c	t	90	E	9	47
Bay of Somme			10		10			15	&	15	na	na	667	5	50	ca	t	na	ERCO	6	50
Bay of Somme	4					12				12	na	na	333	60	240	ca	t	na	ERCO	6	50
Canche & Authie			3		3			20		20	na	na	150	7	21	c	b	na	COE	6	50
Pays de Caux			9		9			na		na	na	na	na	5	45	c	b	na	COE	7	49
Dunkerque	na		15		15	na		20		20	na	na	750	7	105	c	b	na	COC	6	51
GF-Philippe			1		1			40		40	na	na	25	7	7	c	tb	na	RCO	6	51
GF-Philippe	0.2					1				1	na	na	200	57	11	c	t	na	RCO	6	51
Llaine & Boulogne	0.2		na		na	2				2	na	na	100	57	11	c	t	na	COER	6	50
Port Veudres		na	na	na	110		na	na	na	200	150	7.3	550	7	770	asc	tm	75	CL	9	43
Martigues		na	na	na	304		na	na	na	na	na	na	na	7	2128	asc	t	na	CL	9	43
Portugal																					
Rio Minho	8					432				432	200	0.4	19	62	496	c	t	100	E	12	41
Rio Minho			10		10						200	0.5		6	60	c	t		E	12	41
Rio Douro			3.5		3.5			12		20	6	5.8	175	3.1	11	c	t		E	12	41
Other					67									6.7	449	c				12	41
Spain																					
Nalon Estuary	10					100							100		1000	c	t		E	9	42
Pais Vasio	na																		ECO	9	41
Delta del Ebro	na		na																E	9	41
Est y Marismas	na		na																E	10	41
Mar Menor			na																CL	10	41
S'Albufera										200									CL	10	41
Albufera	4		10		10						2	50.0			450	c			CL	10	40
Italy																					
Valli di Comacchio				143	60					110	100	6.0	550	5	300	c	t	0	CL	10	44
Valle Nuova					19					6	19	10.0	3,000	5	95	c	m	0	CL	10	44
Lesina					30					135	51	6.0	200	5	150	c	m	0	CL	10	41
Orbetello					20					60	27	75.0	300	5	100	c	t	0	CL	10	43
Tiber	<1		10		10					10				5		a	m	0	R	9	42
Bracciano					50					60	56	9.0	800	5	250	c	m	0	L	9	42
Fondi					4						4	4.0		5	20	c	m	0	L	9	42
Monaci											1	324.0		5	5	c	t	0	L	9	43
Tortoli					12					10	3	40.0	1,200	5	15	c	m	0	CL	10	40
Total	336	18	2,761	932	8,439	2,590	3	2,130	24	15,380	112,892				69,494						

* Indicates the northern parts of the Swedish east coast, including the island of Gotland

Usage - a: aquaculture, c: consumption, r: research, s: stocking

Status in fishery: - t: target species, b: by-catch, m: eel caught as part of mixed fishery

Waterbody type - R: river, C: canal, L: lake, E: estuary, CL: coastal lagoon, CO: coastal open sea

Warm months - number of months when temperature is greater than 10 C

Table 2. Yellow and silver eel catch and value, from data inventory questionnaire, from fisheries in which yield is 5 kg per ha or greater.
Waterbody type - R: river/lake system; CL: coastal lagoon; E: estuary; ER : river and estuary.

Region	Catch (tonne)	manpower	Area (km^2)	kg/ha	kg/man	ECU per kg	Value ECU * 1000	income, ecu/man	Waterbody type	Warm months	Latitude
Norway											
Imsa	4	3	1	40	1,333	6	24	8,000	R	5	59
Sweden											
Malmohus lakes	35	320	77	5	109	6	217	676	L	5	55
Ireland (Nth)											
Lough Neagh	692	400	380	18	1,730	6	3,582	10,380	L	6	54
Ireland (Rep)											
Waterford Harbour	10	20	20	5	500	4	40	2,000	E		53
Wexford Harbour	10	20	15	7	500	4	40	2,000	E		53
Poland											
Sniordwy Ltd.	25	26	100	3	961	8	200	8,000	L	5	53
France											
Ayrolles-Gruissan	68	34	13	52	2,000	5	340	10,000	CL	6	43
Bages-Sigean	80	27	56	14	2,963	5	400	14,815	CL		
Canet-St Nazaire	8	12	5	17	667	5	40	3,333	CL	6	42
Garonne	74	95	81	9	779	7	518	5,453	ER	10	45
Loire Est & Ir riv	88	465	40	22	189	5	440	946	ER	10	47
Etang Palavasiens	60	38	48	13	1,579	5	300	7,895	CL	6	43
Salses_Leucate	50	28	38	13	1,786	5	250	8,929	CL	6	42
Portugal											
Rio Douro	35	20	6	6	175	3	11	543	E	12	41
Italy								0			
Valli di Comacchio	60	110	100	6	550	5	300	2,750	CL	10	44
Valle Nuova	19	6	19	10	3,000	5	95	15,000	CL	10	44
Lesina	30	135	51	6	200	5	150	1,000	CL	10	41
Orbetello	20	60	27	75	300	5	100	1,500	CL	10	43
Bracciano	50	60	56	9	800	5	250	4,000	L	9	42
Tortoli	12	10	3	40	1,200	5	250	6,000	CL	10	40

Table 3. Glass eel catch and value, from data inventory questionnaire.

	tonne	manpower	kg/man	ecu/kg	value (ecu * 1,000)	income, ecu/man	Boat length (m)	Bank fishing
Great Britain								
Severn	18	508	35	80	1,440	2,835		x
France								
Arcachon glass	3	69	43	78	234	3,391	4-9 m	x
Adour glass	2	63	32	65	130	2,063	na	
Baie du Mt St Michel	3.6	11	273	70	280	19,091	<6m	x
Rade de Brest	4	11	364	60	240	21,818	7-9 m	x
Baie de Seine G	1	45	22	60	60	1,332	<6 m	x
Charente & Seudre	30	150	200	78	2,340	15,600	4-12 m	x
Douve R	0.2	1	230	60	12	13,800	<6 m	
Garonne	29	152	191	78	2,262	14,882	4-12 m	x
Gironde etc.	70	565	124	60	4,200	7,434	4-9 m	
Loire Est & Ir riv	77	253	304	60	4,620	18,261	<6 m	x
Manche Occid.	5.5	11	500	70	385	35,000	7-9 m	x
North Brittany	10	23	435	70	700	30,435	7-9 m	
Odet & Pont L'Ab	0.5	8	63	60	30	3,750	4-12 m	
Orne R	0.05	15	3	60	3	200	<6 m	
Risle R	0.02	1	20	60	1	1,200	<6 m	
Seine Estuary	0.6	45	13	60	36	800	<6 m	
Vilaine	53	110	482	60	3,180	28,909	7-12 m	
Bay of Somme	4	12	333	60	240	20,000	4-9 m	x
GF-Philippe	0.2	1	200	57	11	11,400	<6 m	x
Liaine & Boulogne	0.2	2	100	57	11	5,700	<6 m	
Portugal								
Rio Minho	8	432	185	62	496	1,148	<6 m	x
Spain								
Nalon Estuary	10	100	100	60	1,000	6,000	7-9 m	
Total	342	2,588				7,567		

Table 4. Gear, licences, proportion of fishermen operating as professionals, from data inventory questionnaire.

	Gear types and numbers in use													Fishermen			Number of boats				
Region	Elver dip net	Elver trap	Elver trawl/hamennet	Spear	Fyke < 0.6 m	Fyke 0.8 - 1.5 m	Long line	Pot	Pound net	Stow net	Trap	Trawl	Trammel	Fishing barrier	# licenses	% professional	4 - 6 metre	7 - 9 metre	10 - 12 metre	>12 metres	Bank fishing
Norway																					
Imsa					na									na		75				na	
Skaggerak coast					na		na														
Sweden																					
Coast Blekinge					na		na		na				na		na	na	na	na	na		
Coast Bohus					125k			&	-						na	100	295	&	&		
Coast Gavleborg					180				15						7	40	30	&	&		
Coast Halland					6500				-						30	100	30	&	&		
Coast Kalmar				400	5000		na		325				500		275	25	275	&	&		
Coast Kristianstad					500				188			na			35	60	125	&	&		
Coast Malmohus					5500				50						110	55	220	&	&		
Coast Ostergotland					5000				145						29	25	200	&	&		
Coast Sormland					na				80						20	3	1500	&	&		
Coast Stockholm									na						27	81	37	&	&		
Coast Uppsala					na				-						10	100	10	&	&		
Lake Hjalmaren					na				144						30	100	30	&	&		
Lake Malaren							na		188						47	85	55	&	&		
Lake Vanern					890		700		115						46	16	291	&	&		
Lakes Kristianstad					150		100		19						2	2	240	&	&		
Lakes Kronoberg					na		na		na	na					10	na	250	&	&		
Lakes Malmohus					50		250		85						15	6	320	na			
Lakes Ostergotland					na				na						5	89	9	&	&		
Lakes Skaraborg					na				na						2	20	10	&	&		
Total fresh water		20			1040		1090		>551	5	100				157		1205	&	&		
Total coastal				400	142k		148k		>803				500		>543		>4478	&	&		
Denmark																					
Fresh waters					na				na					110	110	na		na			
Marine waters					160K				5k						32K	2		na			
Harte/Tange		2													2						2
Ireland (Nth)																					
Lough Neagh		1					200			na					200	100		200			
Erne lakes		1			50		50						1	1	28	100	26				
Ireland (Rep)																					
Shannon		2			1.8K					72					108	100	36	4			2
Erne Lakes		1					35							2	35	100	35				5
Waterford Harbour								200							10		10				
Wexford Harbour					200										10	100	10				
Northwestern lakes							7			10					9	100	7				2
Great Britain																					
Severn Estuary	508														508	100					508
Thames Estuary					247							1			248	100	2			2	
Southern rivers	15				2.6K						111	4		5	3K	100				8	
Netherlands																					
Ijsselmeer	1					27K	20K					1			100					100	
Rest of NL Inland					na																
Coast																					
Germany																					
Baltic coast					24K		444K		525			na			25K	na		360	50		
North Sa coast												na			na	na					
Rivers															na	na					
Lakes															587	54					
Poland																					
Sniardwy Co.					120	150				4						100	40				
France																					
Arcachon yellow								24							24	100		24			
Arcachon glass	69														69	35	&	24			45
Adour yellow							&	11							763	12	?				700
Adour glass	763																				
Ayrolles-Gruissan					204										34	100	34				
Bages-Sigean					540		6								48	90	1	39			
B du Mt St Michel	11							2							na	20	11				10
Rade de Brest	40				na										7	20		11			30

Table 4. *(Continued).*

	Gear types and numbers in use														Fishermen		Number of boats				
Region	Elver dip net	Elver trap	Elver trawl/hamennet	Spear	Fyke < 0.6 m	Fyke 0.8 - 1.5 m	Long line	Pot	Pound net	Stow net	Trap	Trawl	Trammel	Fishing barrier	# licenses	% professional	4 - 6 metre	7 - 9 metre	10 - 12 metre	>12 metres	Bank fishing
France (continued)																					
Baie de Seine Y										3		2				100	3		2		
Baie de Seine G	45														15	20	15				30
Canet-St Nazaire					120											0	12				
Pertuis Charentais												na			na	100			na		
Charente & Seudre								450							na	na					
Charente & Seudre	450														600	33	&	150	&		450
Douve R	1														1	na	1				
Garonne								95							95		&	95	&		
Garonne	86														152	40	&	66	&		86
Gironde etc.								500							500	20		250			
Gironde etc.	500														295	33	&	315			
Grand Lieu Lake					200		10	20							9	100	9				
Loire Est & Ir riv								na		1					&		&				
Loire Est & Ir riv	459														461	60	461				200
Manche Occid.	56														11	100		11			45
North Brittany	23				1			1							31	100		23			na
Odet & Pont L'Ab	8				1										10	100	&	11	&		
Orne R	15														15		15				
Etang Palavasiens					38										na	80	40				
Risle R	1														1	na	1				
Saises Leucate					420										8	28	&	30			
Seine Estuary										3		1			na	na	3		2		
Seine Estuary	45														15	45	15				
Vilaine												15			15	100		&	15		
Vilaine	110														110	100		&	110		
Bay of Somme					9		6					na			na	100					
Bay of Somme	12														12	100	&	12			200
Canche & Authie												20			na	100			12		
Pays de Caux												na									
Dunkerque	na											5				100				5	
GF-Philippe												40	10		1	100	1			9	
GF-Philippe	10														2	100	na				na
Liaine & Boulogne	na																				
Port Veudres								<8K								na	na				
Martigues								na													
Portugal																					
Rio Minho			200												432	10	200				na
Rio Minho						na	na														
Rio Douro																					
Other																					
Spain																					
Nalon Estuary	100														100	90		100			
Pais Vasio																					
Delta del Ebro																					
Est y Marismas																					
Mar Menor																					
S'Albufera							na														
Albufera	na				na																
Italy																					
Valli di Comacchio														4							
Valle Nuova						na								1		100					
Lesina					30k										135	100	65				
Orbetello					na									3		100					
Tiber		2			na											100	10				
Bracciano						na		60								100	30				
Fondi											na										
Monaci						100															
Tortoli						180								2							

* Indicates the northern parts of the Swedish east coast, including the island of Gotland

Table 5. Dimensions of gear and summary of conservation measures, from data inventory questionnaire.

	Dimensions of unit (metres, d = diameter of mouth, l = length overall)																		Conservation			
Region	Elver dip net...d	Elver ladder...d	Push net	Elver trawl/hamennet	Box...d	Box...l	Spear	Fyke...d	Fyke...l	Line...# hooks	Pot...d	Pot...l	Pound net...d	Pound net...l	Stownet...d	Stownet...l	Trawl...d	Trawl...l	Weir trap	Cod-end mesh (mm)	Legal season	Closed area	Minimum size
Norway																							
Imsa																							370
Skaggerak coast								0.8	2													3	400
Sweden																							
Coast Blekinge								<0.5	5-10	150											3-10		550
Coast Bohus								<0.5	5-10		na										3-11		370
Coast Gavleborg								<0.5	5-10												6-10		550
Coast Halland								<0.5	5-10												4-12		370
Coast Kalmar							na	<0.5	5-10	150			<22	<2000							5-11		550
Coast Kristianstad								<0.5	5-10				8	<1200			na				7-11/6-8		370/550
Coast Ostergotland								<0.5	5-10												6-9/4-10		550
Coast Sodermanland								<0.5	5-10												5-9		550
Coast Stockholm								<0.5	5-10												6-9		550
Coast Uppsala								<0.5	5-10												5-9		550
Coasts Malmohus								<0.5	5-10				2	730							8-11/3-12		350-550
Lake Hjalmaren								<0.5	5-10				6	250							5-9		550
Lake Malaren								<0.5	5-10	<200			12	140							5-9		550
Lake Vanern								<0.5	5-10	100			na								4-10		550
Lakes Kristianstad								<0.5	5-10	150			na								4-10/6-9		0/550
Lakes Kronoberg								<0.5	5-10	<200			6	250					na		na		550
Lakes Malmohus								<0.5	5-10	150			1.2	190							5-10		350/550
Lakers Ostergotland																					4-10		
Lakes Skaraborg																					4-9		
Denmark																							350/550
Fresh waters								0.5	14				1	50					110	16			450
Marine waters								0.5	14				1	100						11			355
Harte/Tange		0.2																					
Ireland (Nth)																							
Lough Neagh										1000					na					na			300
Erne lakes																				12	5-9		300
Ireland (Rep)																							
Shannon								0.4	14						3	8				12	5-1		
Erne Lakes										1000										12	5-9		
Waterford Harbour											0.5	1.5								12			
Wexford Harbour								0.5	14											12			
Northwestern lakes										1000					3	8				12			
Great Britain																							
Severn Estuary																							
Thames Estuary								0.6	10											12			
Southern rivers																							
Nertherlands																							
IJsselmeer	1				0.1	0.5		1.5	20	2000							3	25		12*		&	280
Rest of NL inland																				12	5-9		280
Coast																							280
Germany																							
Baltic coast								0.3	42	<1600			1.5-3.5	60-200			1.5-2	18		14			450
North Sea coast																							350
Rivers																							
Lakes																							450
France																							
Arcachon yellow											0.45									10			
Arcachon glass	1.2.0.5																				3-9		
Adour yellow										200-800	na									10	11-3		
Adour glass	1.2.0.5																				1-12		
Ayrolles-Gruissan								0.5	50											10	10-4		300
Bages-Sigean								0.5		50m										10	10-4		300
Baie de St Michel	1.2										0.7									10	1-12		
Rade de Brest	1.2.0.5							na												20	11-4		
Baie de Seine Y																0.8	11			40	11-4		
Baie de Seine G	1.2																						

Table 5. *(Continued).*

	Dimensions of unit (metres, d = diameter of mouth, l = length overall)																		Conservation			
Region	Elver dip net...d	Elver ladder...d	Push net	Elver trawl/hamennef	Box...d	Box...l	Spear	Fyke...d	Fyke...l	Line...# hooks	Pot...d	Pot...l	Pound net...d	Pound net...l	Stownet...d	Stownet...l	Trawl...d	Trawl...l	Weir trap	Cod-end mesh (mm)	Legal season	Closed area	Minimum size
France (continued)																							
Canet-St Nazaire								0.5	50												10-4		
Pertuis Charentais																	13			10			
Charente & Seudre											0.2									10	4-11		
Charente & Seudre	1.2		3-7.5x1																				
Douve R	1.2																				11-3		
Garonne											0.2									10	10-4		
Garonne	1.2		3-7x1																		1-12		
Gironde etc.																				8-10	11-3		
Gironde etc.	1.2		5-14x1																				
Grand Lieu Lake									100			2								10	11-3/4		
Loire Est & Ir riv											.2-.35	1-1.5			11x5.5					10-12, 20	2-6		
Loire Est & Ir riv	1.2,0.5																			1-12,	10-12		
Manche Occid.	1.2,0.5																				11-4		
North Brittany	1.2,0.5										0.7									20,10	11-4		22/kg
Odet & Pont L'Ab	1.2																				11-4		
Orne R	1.5x1.2																				11-4		
Etang Palavasiens								0.5	50											10	10-4		300
Risle R	1.2																				1-12		
Salses_Leucate								0.5	50											10	10-4		300
Seine Estuary															0.8			10-11		40			
Seine Estuary	1.5x1.2																						
Vilaine																	na			20	10-4		
Vilaine	1.2																				1-12		
Bay of Somme								na		na							na				11-4		
Bay of Somme	1.2																						
Canche & Authie										na							na				1-5		
Pays de Caux																	na						
Dunkerque	na																12						
GF-Philippe																				20-80			
GF-Philippe																							
Licine & Boulogne	1.2																na				1-4		
Port Veudres											0.5	5-30								10	1-4	?	22/kg
Martigues											0.5										1-12		22/kg
Portugal																							
Rio Minho								0.8	2	na										15	9-11		
Rio Minho	.75-1.5			15																1-2	10-4		200
Rio Douro	1																				9-11		
Other	na																						
Spain																							
Nalon Estuary																				1-2			
Pais Vasio	na							na	na												10-4		
Delta del Ebro																							
Est y Marismas										na													
Mar Menor																							
S'Albufera																							
Albufera								<1.5					>1.5										
* Indicates the northern parts of the Swedish east coast, including the island of Gotland																							

Table 6. Influences on stock and catch. Data for 1994, except Netherlands (1993) and Sweden (1995).

		Productive water area (square km)		Stocking (t)			Minimum size, mm	Price ECU/kg		Year of data
		Potential	Actual	within system	between systems	international		Glass eel	Yellow/silver	
Coastal	Norway	na	1,000	0	0	0	400		6	94
	Sweden	34,100	18,700		26	<1	350-550	120	6	94
	Denmark	7,000	7,000			22	295-380		5-7.5	94
	N. Ireland	0	0	0	0	0				
	Rep. Ireland	0	0	0	0	0				
	Britain	0	0	0	0	0				
	Netherlands	5,000	5,000	0	0	0	280		6	94
	Germany	13,200	3,600	0	0	1	350-450		6-10	94
	France	na	na	0	0	0			5-6	94
	Portugal	na	na	0	0	0	200			
	Spain	na	na	0	0	0				94
Estuarine	Norway	na	na	0	0	0				
	Sweden	0	0	0	0	0				
	Denmark	0	0	0	0	0				
	N. Ireland	na	na	0	0	0				
	Rep. Ireland	30	30	0	0	0			5	94
	Britain	na	na	0	0	0				
	Netherlands	0	0	0	0	0				
	Germany	na	na	0	0	0				
	France	na	na	<1	<1	na		60	5-6	94
	Portugal	na	na	0	0	0	200	62	3-6	94
	Spain	na	na	0	0	0		94		94
Lagoon	France	na	na	0		0		60	5-6	94
	Portugal	na	na	0	0	0	200			
	Spain	na	na	0	0	0				
	Italy	150,000	61,000	0	27	&				89
Inland	Norway	na	na	0	0	0				
	Sweden	17,570	11,000	0	59	<2	0-550	120	6	94
	Denmark	600	600	0	0	5	450		6-7.5	
	N. Ireland	600	525	8	2-4	2-4	300		6	94
	Rep. Ireland	835	720	2	1	0			5	94
	Britain	na	na	0	0	0				
	Netherlands	7,000	7,000	3	0	5	280		6	94
	Germany	na	2,300	0	18	20	350-450		6-10	93
	France	na	na	0	0	0			5	
	Portugal	na	na	0	0	0	200		3-6	94
	Spain	na	na	0	0	na				

Table 7. Manpower, boats and catch. Data for 1994 except Germany (1993).

		Numbers of fishermen				Numbers of boats		Catch (t)		Year of data
		Fulltime	Part-time	Occasional	Recreational	<12 m	=>12m	Glass eel	Yellow/Silver	
Coastal	Sweden	356	562	399	3,150	>4,467	na		1000	94
	Denmark		660	16,000	16,000	660	na		1357	94
	Netherlands		100				50		200	94
	Germany		1,560			1,050	>70		520	93
	France			200	na	100	100		300	94
	Portugal									
	Spain									94
Estuarine	Rep. Ireland		50			25			50	94
	Britain							18		
	Germany									
	France		900	300	na	1,000		300	200	94
	Portugal		na	na	na	na		na	na	
	Spain		na	na	na	na		150	100	
Lagoon	France		150	na	na	150			1000	94
	Portugal									
	Spain									
	Italy	na		na		na		na	900	94
Inland	Sweden	23	123	300	2,085	>2,531			130	94
	Denmark		200	750	750	200			423	94
	N. Ireland	6	400			230			735	94
	Rep. Ireland	6	200		15,800	100		3	250	94
	Britain									
	Netherlands	50	750		500,000	250	120	3	685	94
	Germany		320	267					678	93
	France			350	10,000	20	20		700	
	Portugal									
	Spain									
	Italy							na		
Total		441	5,975	18,566	547,785	3,785	290	474	9,228	

Full-time eel fisherman (eel value >= 80% of total income)
Part-time eel fisherman (>= 20% eel value <80%)
Occasional eel fisherman (>0% eel value <20%
Recreational fisherman ("own consumption", fish killed)

Table 8. Fishing gear types and minimum numbers in use.

		Glass eel			Yellow eel					Silver eel	
		Elver dip net/hamennet	Push net & trawl	Elver trap	Trap/pot/box/spear	Fyke net	Longline	Trawl/Trammel	Drainable pond	Riverine gear	Pound net
Coastal	Sweden				400	147,680	na	500			>803
	Denmark					100,000	na				5,000
	Ireland (Nth)						na				
	Ireland (Rep)										
	Great Britain					>974					
	Netherlands				na	na		na			
	Germany				>24,600		444	5			
	France				24	9	6	60			
	Portugal										
	Spain	na									
Estuarine	Ireland (Nth)			2							
	Ireland (Rep)			4	500	2,500					
	Great Britain	550			>200	>247		>5		>5	
	Germany										
	France	2,060	216	700	>1048	>2	na	36			
	Portugal	>200			na	na	na				
	Spain		> 100			na					
Lagoon	France					1,000	1,500				
	Portugal				na						
	Spain	na				na	na			na	
Inland	Norway					na				na	
	Sweden			20		>1,090	1,050			105	>551
	Denmark			2*2		na	na			110	na
	Ireland (Nth)					56	250			2	
	Ireland (Rep)				5	1,800	35			74	
	Great Britain				>200	>2,835				>10	
	Netherlands	1*2			22,000	>27,000	10	2*2			
	Germany										
	France				2,000	1,000	na		2,000	158	
	Portugal					na	na				
	Spain										

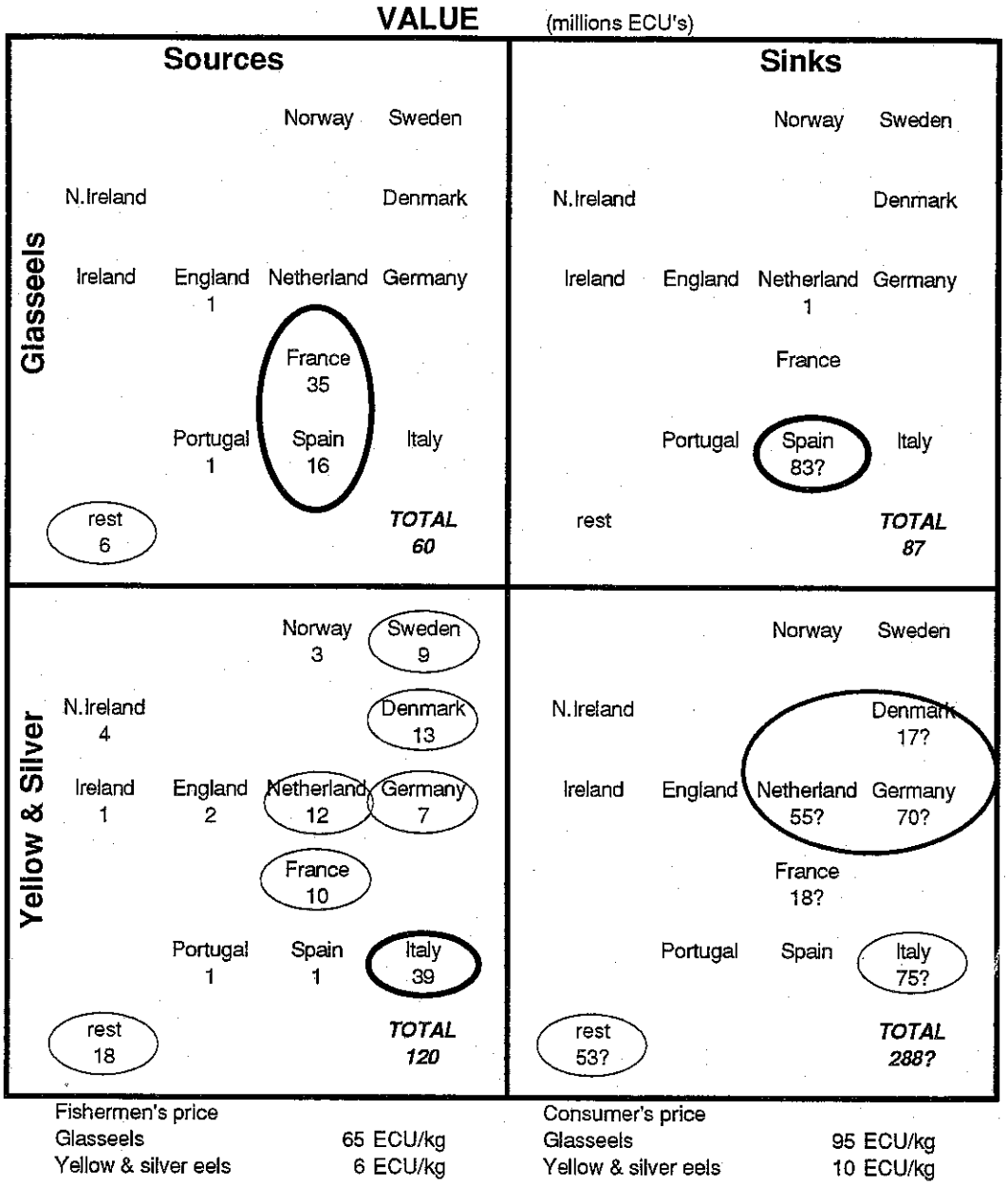
Table 9. Opinions of participants on trends in fishery and habitat. Improvement (+), deterioration (-).

	Fishery			Management				Chemistry			Physical			Biological		
	Glass	Yellow	Silver	Stocking	New populations	Improved control	Fish passes	BOD	Nutrients	Toxic chemicals	Impassable dams	Turbines	Reclamation	Anguillicola	Heavy metals	Organochlorine
1900 - 69																
Norway		+	-		+				-	-	-	-	-		-	-
Sweden	+	+	+				+	-	-	-	-	-			-	-
Denmark					-		+				+					
Ireland (Nth)												-	-			
Ireland (Rep)		-	-	+							-	-	-			
Great Britain					-				-	-			+		-	-
Netherlands	+	+	+	+		+				-			-		-	-
Germany		+		+												
Poland		+	+													
France																
Portugal		+				+					-					
Spain																
Italy																
1970-1989																
Norway			-					+	+	+			+		+	-
Sweden	-	-	-	+	+		-	+	+	+		-				-
Denmark	-	-	-		-				-		+	-	-			
Ireland (Nth)	-			+									+			
Ireland (Rep)	+	+	+	+		+	+		-							
Great Britain	+	+	+		+			-	-	-			+	-	-	-
Netherlands	-	-	-	-	+	-					+		-	-	-	-
Germany	-							-	-					-	-	-
Poland		+	+					-	-	-	-					
France																
Portugal	+	+						-	-	-	-	-			-	-
Spain	-						+				-					
Italy	+			+		+		-	-		-					
1990-96																
Norway								+	-	-				+		
Sweden	+-	+-	+?	+	+	+	-	+	+	+				-	+	+
Denmark				+			+				-			-		
Ireland (Nth)	-		-	+					-			-				
Ireland (Rep)	+			+					-			-				
Great Britain	-	-	-	+		+	+	-	-	-						
Netherlands		-	-	-		-	+	-	-	+					+	
Germany	-			-											+	+
Poland		-	-	-				-	-	-	-					
France																
Portugal	-	+				+		-	-	-	-			-	-	-
Spain																
Italy	-			-												

Table 10. FAO statistics for 1993 and group's estimates of total catch.

FAO Yearbook data 1993					Working Party estimate for capture fishery and EIFAC/ICES estimate for aquaculture production						
	Inland waters	*Atlantic/Baltic*	*Mediterranean*	**Total (tonne)**	*Year*	*Inland waters silver/ yellow*	*Atlantic/Baltic glass*	*Atlantic/Baltic silver/ yellow*	*Mediterranean silver/ yellow*	*Aquaculture*	**Total (tonne)**
Albania	210			**210**		210					**210**
Belarus	13			**13**		13					**13**
Belgium	125			**125**						100	**100**
Croatia			5	**5**					5		**5**
Czech Rep.	32			**32**		32					**32**
Denmark	957	880		**1,837**	1994	420		1,360		1,000	**2,780**
Estonia	49	10		**59**		85		10			**95**
Finland	0			**0**		10					**10**
France	810	181	685	**1,676**	1993	700	300	500	1,000	25	**2,525**
Germany	774	253		**1,027**	1993	800		400		100	**1,300**
Greece	337		17	**354**					17	337	**354**
Hungary	263			**263**		263					**263**
Ireland	150			**150**	1994	250	3				**253**
Italy	1,985		1,505	**3,490**		100			2,940	2,020	**5,060**
Latvia	18			**18**		18		2			**20**
Lithuania								6			**6**
Netherlands	375	43		**418**	1994	685	3	200		1,500	**2,388**
Norway		340		**340**	1994	4		400		120	**524**
Poland	800	316		**1,116**		800		316			**1,116**
Portugal	502	35		**537**	1994	100	40			100	**240**
Russian Fed.	16	19		**35**		16		19			**35**
Slovakia	7			**7**		7					**7**
Spain	150	25	70	**245**	1994		150	192		155	**497**
Sweden	321	1,015		**1,336**		129		1,016		192	**1,337**
Switzerland	4			**4**		4					**4**
Turkey	261			**261**						261	**261**
UK Engl/ Wales	50	38		**88**	1993	300	20	50			**370**
UK N. Ireland	662			**662**	1994	735					**735**
Yugoslavia			8	**8**					8		**8**
											0
Euro-total				**14,316**							**20,548**
											0
Algeria	23			**23**				23			**23**
Morocco	100		70	**170**		200		100			**300**
Tunisia			373	**373**				373			**373**
											0
Afro-total				**566**							**696**
World total	8,994	3,155	2,733	**14,882**		5,881	516	4,967	3,970	5,910	**21,244**

Figure 1. Geographical distribution of production and consumption of eel by value.



Summary of sources		Glasseel	Y&S eels
weight	tonnes	920	19977
numbers	millions	2760	100
value	M ECU	60	120

Summary of sinks		Glasseel	Y&S eels
weight	tonnes	920	28800?
numbers	millions	2760	144?
value	M ECU	87	288?

Summary of sources in percentages		Glasseel	Y&S eels
weight	tonnes	4%	96%
numbers	millions	97%	3%
value	M ECU	33%	67%

Summary of sinks in percentages		Glasseel	Y&S eels
weight	tonnes	3%	97%
numbers	millions	95%	5%
value	M ECU	76%	24%

Figure 2. Geographical distribution of production and consumption of eel by weight.

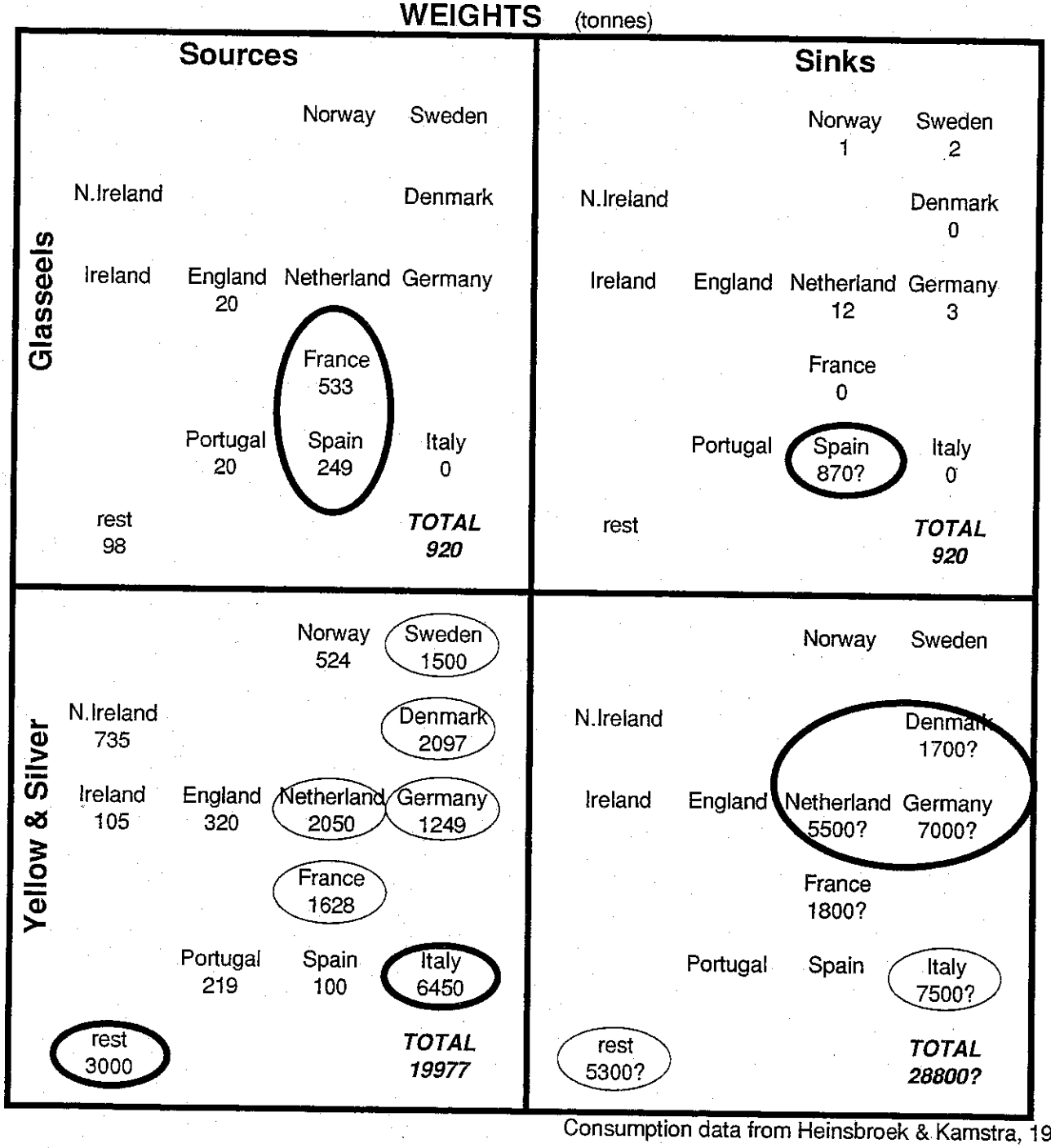
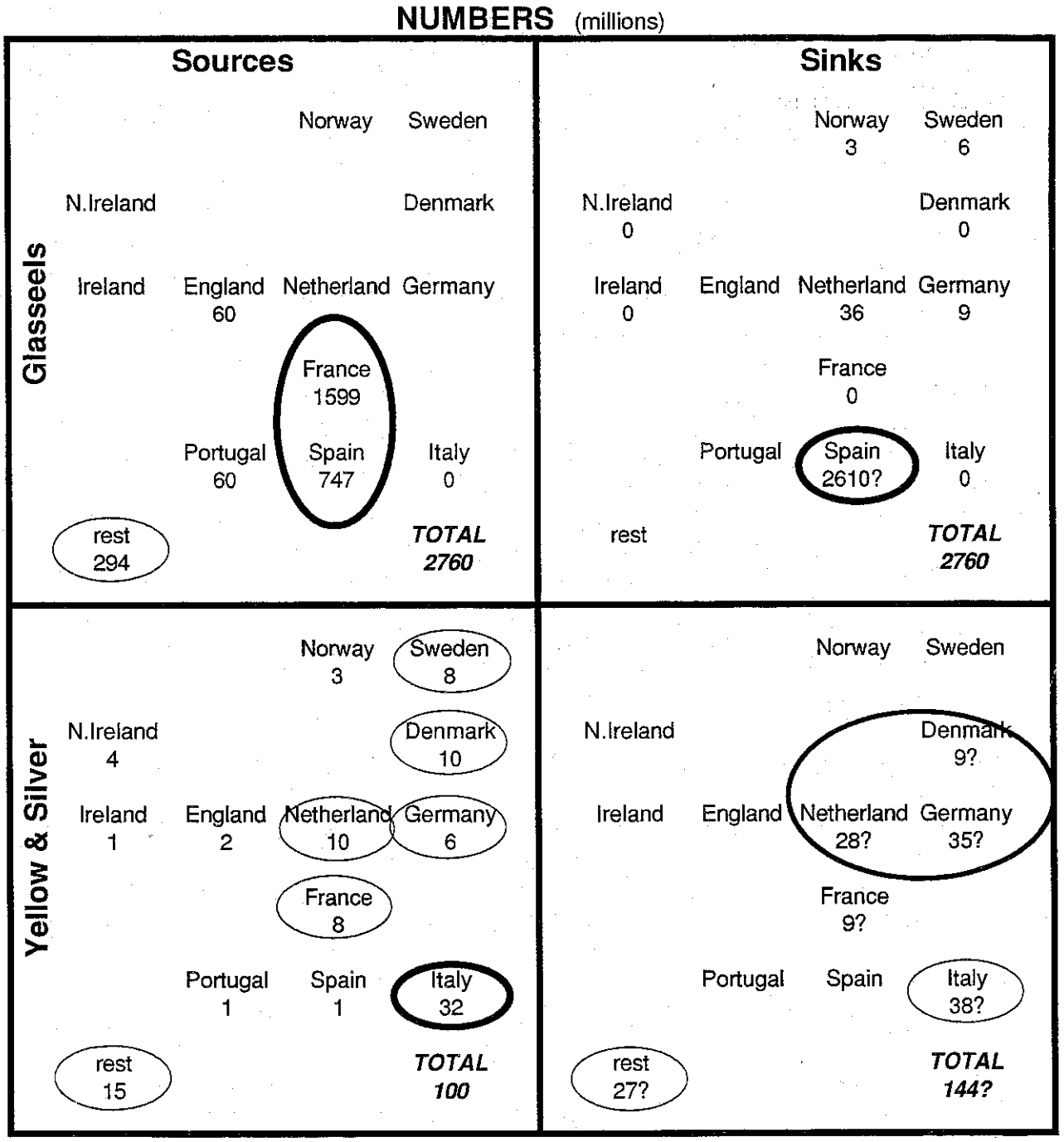


Figure 3. Geographical distribution of production and consumption of eel by numbers, calculated on basis of 3,000 glass eel per kg and 5 yellow and silver eel per kg.



Appendix 1. Questionnaire forms for completion by participants.

AIR Concerted Action A94-1939

Enhancement of the European eel fishery and conservation of the species

Notes on Questionnaire on available information

FORM 1 - DATA INVENTORY

The aim of the Data Inventory is to compile information for the entire area covered by the Concerted Action. It is certain that the data will be incomplete in all cases and that many of the forms will be based on very rough estimates. It is equally certain that completion of the inventory will be a major step forward in bringing together the best estimates by national experts. The data on catch will be much more meaningful than the FAO statistics and will also provide for the first time an estimate of the numbers of people involved in the eel fishing industry in Europe. You are therefore requested to complete as many forms as are needed to cover your country - with the clear understanding that the accuracy of the estimates will vary greatly between regions.

Region. The region is one or more water bodies. Fill in one form per region. The ideal region would be a discrete water body such as a lake, with a more or less homogeneous fishery. Such ideals will probably prove to be the exception rather than the rule. Therefore it is expected that each country will manage to define one or more discrete water bodies but that most of the regions will be large and diffuse. The Ijsselmeer, the Loire estuary and Lough Neagh are discrete. The German Baltic Coast is homogeneous, but very large. To complete coverage it will be necessary to use some very large and diffuse regions. For example, in Ireland we hope to provide data for four self contained regions: the Shannon, the Erne, the Corrib and the Bann but we will need two very diffuse ones, namely *Inland waters other than Shannon, Erne, Corrib and Bann* and *river estuaries*.

Longitude and latitude Give one point only, the idea is to distinguish between distant regions

Surface area Estimate productive area only - omitting for example deep parts of large lakes. This may be difficult for marine waters - recommended criterion is area within which eel-fishing boats operate. Try to make some kind of estimate, to nearest 100 or even 1000 km^2 if need be. The aim is to give an indication of the order of magnitude of the extent of the eel fishery.

Man-made modifications Physical, such as dams etc., chemical including nutrients and toxins

Gear An important aim has been to keep the questionnaire as simple as possible and therefore only four columns are being given for individual types of gear. This section is to describe the gear and its dimensions. The total number of nets, lines etc. should go under *Effort* The four columns should be enough for the 'discrete' regions. Give dominant gears for extensive regions - without attempting to list everything. The fifth column 'gears combined' is to deal with cases in which statistics are available for the whole region and are not available for each type of gear.

Appendix 1. *(Continued)*

Manpower Number of licences is one of the very few data sets where a good degree of accuracy can be expected. Numbers of fishermen and percentage of professionals amongst them will be subjective. A professional fisherman is one who gains more than 20% of his livelihood from eel fishing.

Catch Give total according to official statistics (write 'na' when not available). Best estimate is your own opinion of what the actual catch may be, to include unreported or unpublished data.

Under grading data indicate years for which data relative to size distribution may be available.

FORM 2 PERSONAL OPINIONS

The *Personal opinions* form is seeking estimates of changes which have taken place *within entire countries* under three time-spans. The first, 1900-1969, is historical The second, 1970-89 was to cover the period for which most of the participants have been engaged in eel studies but was extended backwards to include the 1970s and the 'boom years' for elver catch in many countries. The third, 1990-95 is for recent happenings. The columns should be completed using the symbols given at the bottom of the form which indicate trends - estimates of quantities or numbers should not be given.

The symbols D and I are to be used subjectively. For example, an increase in the number of dams, turbines etc. is a deterioration of the habitat and therefore merits D rather than I.

Appendix 1. *(Continued)*

Form 1 Data inventory AIR3-CT94-1939

Country						
Region						
Longitude, Latitude of central part of region (degrees, minutes E or W)						
Surface area of water believed to produce eel (km^2)						
Number of months when temperature is greater than 10°C						
Waterbody type						
Man-made modifications to waterbody (I/C/T/TB/D/E/P)						
Gear	Type					Gears combined
	Local name					
	Length of unit (m) or no. of hooks					
	Mouth diameter (m)					
Manpower	Number of licences					
	Number of fishermen (total)					
	% professional					
	Boat (type or no-boat)					
	Local name					
	Number					
	Length overall (m)					
Product	Life stage G/B/Y/S					
	Status in fishery T/B/M					
	Usage A/C/S/R					
Regulations	Mesh (cod-end knot to knot, mm)					
	Gear numbers					
	Legal fishing season (months 1-12)					
	Closed area					
	Minimum legal size of fish (mm)					
Effort	Unit					
	Total current effort					
	Data years					
	Natural fishing season (months 1-12)					
Catch (tonnes)	Official figure for total catch					
	Best estimate					
	Data years					
	Grading data (data years)					
	Scientific sampling (data years)					
	Artificial stocking (as % of recruitment)					
Trade	Current price (ECU/kg)					
	% exported, by value					

Notes
Water body type : R: river **C:** canal **L:** lake **E:** estuary **CL:** coastal lagoon **CO:** coastal open sea
Life stage : G: glass eel (<8 cm), **B:** bootlace (8-30cm), **Y:** yellow (> 30cm), **S:** Silver, or combine (e.g. **Y + S**)
Status in fishery: T: target species, **B:** by-catch, **M:** eel caught as part of mixed fishery
Usage: A: aquaculture, **C:** consumption, **R:** research, **S:** stocking.
Modifications: I: Impoundments **C:** canalisation **T:** turbines **TB:** tidal barrage **D:** drainage **E:** eutrophication **P:** pollution

Appendix 1. *(Continued)*

FORM 2 PERSONAL OPINIONS AIR3-CT94-1939

Country		Respondent's name			
			1900-69	1970-89	1990-95
Fishery	Glasseel	catch			
		CPUE			
		# fishermen			
	Bootlace	catch			
		CPUE			
		# fishermen			
	Yellow	catch			
		CPUE			
		# fishermen			
	Silver	catch			
		CPUE			
		# fishermen			
Management practice	Stocking of existing fisheries				
	Creation of new eel populations				
	Optimisation of fisheries by regulations				
Habitat	BOD (Biological oxygen demand)	Inland			
		Estuary			
		Lagoon			
		Sea			
	Nutrients	Inland			
		Estuary			
		Lagoon			
		Sea			
	Toxic chemicals	Inland			
		Estuary			
		Lagoon			
		Sea			
	Obstructions - upstream	Impassable dams			
		Dams with passes			
	Obstructions - downstream	Turbines/pumping			
	Land drainage				
	Land reclamation				
	Creation of new lakes				
Contamination and parasites		Anguillicola			
		Heavy metals			
		Organochlorines			

D Decrease (catch) or deterioration (quality of habitat)
I Increase (catch) or improvement (quality of habitat)
V Highly variable, with no trend (> x 3 within the period)
N No drastic change (< x 2 within the period)
U Unknown

Appendix 2 Names and addresses of participants. R Lecomte-Finiger and A Legault were unable to attend the meeting in Dublin. E Ciccotti joined the group after the Dublin meeting.

Sweden

Stellan Hamrin — National Swedish Board of Fisheries, Institute of Freshwater Research, S-178 93 Drottningholm.

Hakan Wickström — National Swedish Board of Fisheries, Institute of Freshwater Research, S-178 93 Drottningholm.

Denmark

Michael Pedersen — Danish Institute for Fisheries Research, Inland Fisheries Laboratory, Vejlsøvej 39, DK-8600 Silkeborg,

Ireland (Northern)

Robert Rosell — DANI, New Forge Lane, Belfast BT9 5PX.

Ireland (Republic)

Christopher Moriarty — The Marine Institute, Fisheries Research Centre, Abbotstown, Dublin 15.

Julian Reynolds — Department of Zoology, Trinity College, Dublin 2,

Great Britain

Brian Knights — Applied Ecology Research Group, University of Westminster, 115 New Cavendish Street, London W1M 8JS,

Netherlands

Willem Dekker — RIVO-DLO, PO Box 68, 1970 AB IJmuiden

Germany

Eka Hahlbeck — Bundesforschungsanstalt für Fischerei, Institut für Ostseefischerei, An der Jagerbäk 2, 18069 Rostock,

Holmer Kuhlmann — BFA-Fischerei, Inst. für Fischereiökologie, Wulfsdorfer Weg 204, 22926 Ahrensburg

France

Yves Desaunay — IFREMER, Centre de Nantes, Rue de l'Ile d'Yeu - BP 1105, 44311 Nantes Cedex 03

Guy Fontenelle — Laboratoire Halieutique, ENSA, 65 Rue de St Brieuc 35042, Rennes Cedex

Raymonde Lecomte-Finiger — EPHE, Université de Perpignan, Avenue de Villeneuve, 66860 Perpignan Cedex,

Antoine Legault — Fish Pass, 85 Rue de St Brieuc, 3500 Rennes,

Portugal

Maria Assunção Santos — Instituto de Ciências Biomédicas de Abel Salazar , Universidade do Porto, Lg. Prof. Abel Salazar 2 , 4000 Porto

Spain

María José Lara — c/. Cabrales N°84, 9°C, 33201 Gijón Asturias

Italy

Eleonora Ciccotti — Laboratorio di Ecologia Sperimentale ed Acquacoltura, Università 'Tor Vergata', Via della Ricerca Scientifica, 00133 Rome, Italy.